THE PLANT DISEASE REPORTER

Issued By

Division of Mycology and Disease Survey

Supplement 112

The 1938 Wheat Leaf-rust Epiphytotic in Oklahoma

March 1, 1939.

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

THE 1938 WHEAT LEAF-RUST EPIPHYTOTIC IN OKLAHOMA

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Introduction

Few Oklahoma records are available on which to base a comparison of the 1938 leaf-rust (*Puccinia rubigo-vera tritici*) epiphytotic with outbreaks of former years. The veteran wheat growers and wheat specialists who have been consulted have agreed that the 1938 outbreak was the earliest and most extensive which they can remember. Yet it is apparent that in the past the leaf rust has frequently been very prevalent in the state. Growers report that it has not been uncommon to find their clothes red with spores when passing through the fields of mature wheat, or to have the air filled with red spore dust at harvest. A few reports have been received of wheat which became so rusty in the fall that its value as pasture was considerably reduced. But in Oklahoma, as doubtless in many other wheat-growing states, both practical and professional agriculturists have come to look upon "red rust" as a common and harmless disease in contrast to the acceptedly dangerous "black rust". Black stem rust of wheat is rarely a disease problem in Oklahoma, but very few Oklahoma wheat growers and others interested in the crop realize that "black rust" in Oklahoma is nearly always the later stage of orange leaf rust.

The Weather Record (7)1/

Encouraged by the bountiful harvest and favorable price in 1937, the wheat acreage planted in the fall of 1937 mounted to about 14 percent above the acreage planted the previous year. In its fall development the wheat was subjected to an unseasonably cool and dry November and a cool December in which the rainfall was slightly below normal. Wheat was in fair condition by the end of November although its growth had been checked by low temperatures, and by the end of December the pastures were quite short and the crop was in need of moisture.

The first three months of 1938 were all abnormally warm, the departures from normal being +3.9°, +5.4°, and +7.3° for January, February, and March, respectively. Precipitation was approximately normal for January, but in February a 50-year record high began a period of excessive rainfall which was to carry through till harvest, the accumulated precipitation by

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1/ Numbers in parentheses refer to Literature Cited.

June 30 being 23.28 inches as compared with 16.86 inches for a normal year. The temperature and precipitation records for the months in question are included in Figure 1. In only three years during the past 47 (1889, 1908, 1915) has the average precipitation for January-June been as great as in 1938. The excess precipitation was not evenly distributed over the State. It was greatest in the east and in the large central wheat-producing belt. The extreme southwestern part of the State was rather dry, and true drought conditions prevailed in the western half of the Oklahoma Panhandle[2].

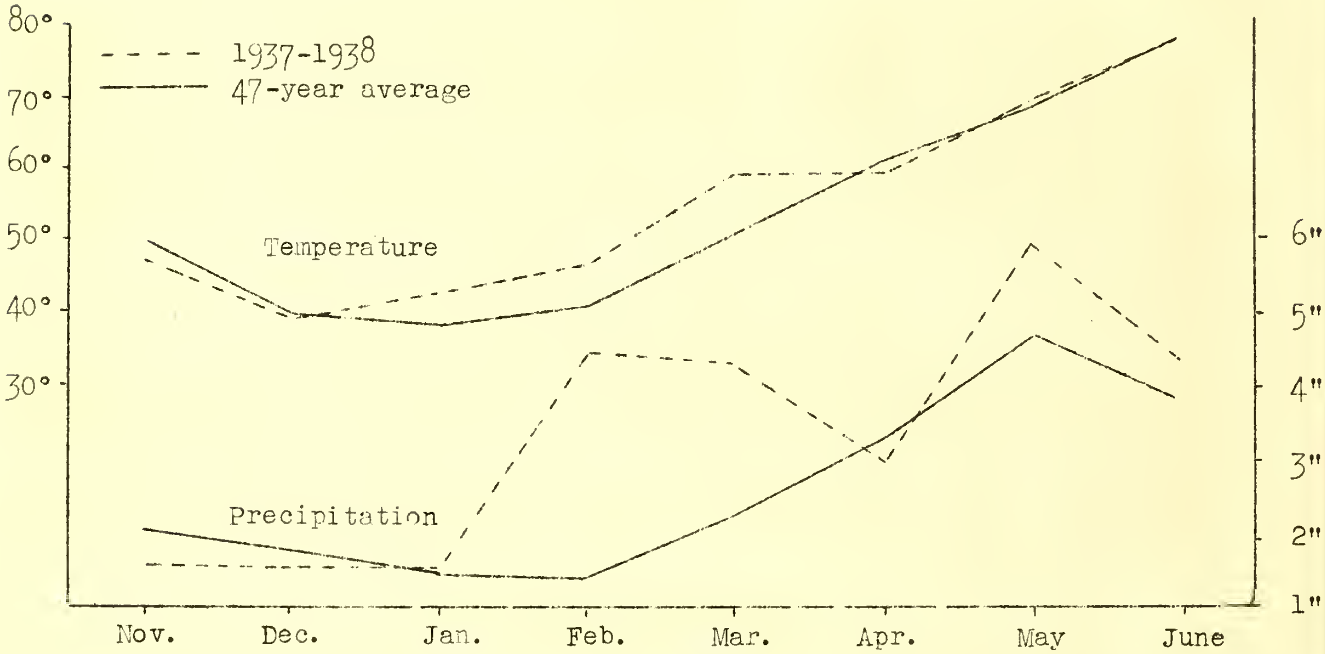

Figure 1. Average monthly temperature and precipitation for Oklahoma, 1937-38, as compared with the 47-year averages.

The only other outstanding feature of the meteorological record for the period in question was the series of sub-freezing temperatures in early April. During the opening week of April, late frosts killed back much of the earlier peaches and other fruits, and these were followed by an unprecedented 4-inch snowfall on April 7 and 8. However, the official Oklahoma weather report for April does not indicate general injury to the wheat crop as a direct result of the low temperatures. ("Wheat made rather rank growth and the crop was in good to very good condition at the close of the month,

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2/ For geographical references, see map (Fig. 2) under "Appendix".

although orange rust was prevalent throughout the state and was severe in the north-central and central counties." 7, Vol. 27, No. 4). The usual strong south winds prevailed throughout the spring. The 1938 hail damage to crops was $238,700 less than in 1937[3/]. Dust storms were frequent but were hardly a factor in wheat production except in the drought-ridden western half of the Oklahoma Panhandle.

It is commonly understood (2) that the conditions requisite to epidemic leaf-rust development include a sufficiency of overwintered inoculum, warm weather with an abundance of moisture in the spring, and an extensive acreage of susceptible wheat varieties. The foregoing meteorological account accords with this conception of predisposing factors. The mild winter permitted the rust to overwinter to a large extent, judging by the abundance of early spring infections. The warm temperatures and persistent rainfall throughout the spring permitted an unbroken series of secondary infection cycles from early spring until harvest. The ample moisture and the temperatures in the 60's from March until May stimulated the wheat to the rank, succulent type of growth most susceptible to the disease. Figures are not available on the acreage distribution by varieties, but it is known that large areas were planted with such susceptible varieties as Turkey, Blackhull, Fulcaster, and Cheyenne.

The Development of the Disease

It is regrettable that Oklahoma wheat fields were not examined for the presence of leaf-rust during the period of November 1937 to March 1938. No record of the disease in 1938 prior to the Oklahoma report of April 2 (P.D.R.[4/] 22: 115) has come to hand. A few days before this date a large amount of the rust was observed in fields in the vicinity of Stillwater, Oklahoma. The wheat was about 9 inches high, and was so heavily infected that the fields already looked yellow and scorched in spite of abundant rainfall. Although data were lacking for a comparison of this rust development with that of other years, cereal specialists consulted were of the opinion that the rust was abnormally early in its appearance. This is in accord with the unusually early appearance of oat crown rust [*P. coronata*] (P.D.R. 22: 117, 135) and stem rust [*P. graminis*] (P.D.R. 22: 137) in Texas, of leaf rust, crown rust, and stem rust in Kansas (P.D.R. 22: 143, 242), of crown rust in Arkansas (P.D.R. 22. 181), and of stem rust in Oklahoma (P.D.R. 22: 157).

On April 23 and 24, 98 wheat fields were examined along a circuitous route through the major wheat sections of the west-central part of the State (P.D.R. 22: 133). Leaf rust was found in abundance at nearly all points. The region of greatest damage was in the west-central area from El Reno to

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3/ Figures obtained by totalling crop losses due to hail as reported in (7), March to July, 1937 and 1938.

4/ Here and elsewhere in this paper "P.D.R." refers to the *Plant Disease Reporter*.

Enid, the heaviest wheat-producing region of the State. At this time an average of 30 percent of the leaves had been destroyed while in many fields the leaf-damage had reached 40 to 50 percent. The remaining leaves were for the most part thickly spattered with the tiny yellow flecks marking incipient rust destruction. But the color of a wheat field is the color of the uppermost leaf or two, and as these leaves were still green the fields from a distance showed a false appearance of healthy, vigorous condition. Very little of the wheat had begun to head, and from the presence of the incipient lesions it was apparent that the trouble would soon assume a more menacing aspect.

During the following week, April 24 to 30, the rust became obvious with a spectacular suddenness. Fields which a few days previously had been a rich, dark green were now rapidly turning yellow, as the last leaves died before the production of heads, and six to eight weeks before harvest. The striking change led one seasoned crop scout to refer to the appearance of the fields as "death pallor". This condition involved half the wheat in the State. It prevailed generally over the State except in the fields of rust-resistant wheat varieties and in the drier regions around Woodward and westward into the Panhandle.

At about this time growers and millers became concerned about the trouble and unsolicited letters began to pour in asking for information on the trouble and prospects of crop damage. A letter was sent to all county agents acquainting them with the situation, and requesting information on the progress of the disease. The following excerpts from letters are instructive:

> "There has not appeared to be much apparent damage up to about a week ago. Now, however, an increasing number of farmers have been coming into the office reporting rust in their wheat. The apparent damage has been increasing rapidly within the last few days. Fields that were a good healthy dark green a week ago are heavily tinged with orange at present. In all fields I have examined there seems to be some rust, at least in the lower leaves. However, in the majority of fields there is no apparent damage up to now. It does seem, though, that the complexion of these fields has been changing rather rapidly in some instances."--Charles Gardner, County Agent, Taloga, May 3, 1938.

> "Wheat in this community seems to have been deteriorating in the last few days."--E. O. Swaim, Mgr., Blackwell Coop. Elevator, Blackwell, May 3, 1938.

> "Rather heavy damage looks almost certain."--A. R. Garlington, County Agent, Pawnee, April 26, 1938.

"The rust seems to be worst in bottom land and this on the Burtscki farm has probably damaged the crop 80 percent. The damage on the Bob Wheeler farm was about 50 percent. Rust has caused about 30 or 40 percent damage to bottom land wheat throughout Grady County. It is not damaging the wheat seriously on upland."--Lant Hulse, County Agent, Chickasha, April 30, 1938.

"I am enclosing some samples taken from a 30-acre wheat field in Fitzhugh, Oklahoma. This field of wheat I am sure is worth nothing for a grain crop and feel sure that it will be turned under within the next few days and prepared for another feed crop."--J. B. Hill, County Agent, Ada, May 3, 1938.

And the following characteristic account May 3 from the manager of a large flour mill, who is anonymous by request. Typography as in the original.

"I have been going into the city to see the ball games, and as driving along the road I would notice the growing wheat. It all looked nice and green from the road that I take to avoid traffic. As stated the wheat looked nice and green. However when coming home Sunday afternoon I again noticed the wheat and Monday morning I told Mr._______ that the wheat was already starting to turn and it would not be long now before harvest. The wind was blowing and the wheat was waving and I noticed it all had a shade of light yellow. Well, Monday evening I went out to those fields and while they were turning yellow all right yet THEY WERE NOT RIPENING FOR THEY HAVE NOT EVEN HEADED OUT YET. That yellow that I saw from the road was dead leaves and not headed wheat starting to ripen."

A second trip through the State, following a route similar to that of April 23 to 24, but extending farther into the Northwest section, was made on May 7, 8, and 9 (P.D.R. 22: 157). The heads were now beginning to emerge, and here and there a field was fully headed, although the grain had not yet started to fill. The emergence of the green heads brought about another sudden transformation in the appearance of the fields. Fields which a week ago were yellow and scorched were now rapidly regaining a green luxuriance, and with this change the fears of the farmers rapidly subsided. Few understood the vital relationship of the leaves in providing the necessary substances for the filling of the kernels, or realized that their wheat crop of 1938 was an attractive superstructure without an adequate foundation.

Pathologically, the situation was that of the end of April, with the further developments that might logically have been expected. The inconspicuous pin-point infections of the upper leaves had now developed into destructive pustules, until in many fields the last remnant of leaf tissue had been killed before the heads emerged. Stem rust was just appearing in the central part of the State at this time. (P.D.R. 22: 157). The area of greatest leaf-rust infection coincided with the area of greatest wheat production in the State, a band beginning at Grady and Caddo Counties and extending northward with increasing damage through Canadian, Blaine, Kingfisher, Garfield, and Grant Counties, and thence into Kansas. (See map, Figure 2, in "Appendix").

To the west of this area the disease decreased with the decrease in rainfall. Wheat in Woodward County was showing 1 to 5 percent infection when wheat from Canadian to Grant Counties was 30 to 50 percent infected. The northwestern counties received more than their share of the late spring rains, and by harvest time the wheat in this area was heavily infected. Nevertheless, the damage to the crop was not great because of the lateness of the rust attack. Beaver County in the Panhandle, adjoining the drought area, completely escaped the disease.

In the southwestern part of the State the rust infection was only slightly less severe than in the central part, except in Jackson, Harmon, Greer, and Beckham Counties at the extreme west, where dry weather was the limiting factor. The wheat in the southwestern counties also received more than its share of injuries from other causes, in particular from army worms, brown mites, frost, and hail.

East of the main area of infection, the disease was irregular in its distribution and severity. The principal factors concerned in the irregularity appear to be the isolation of many of the fields, the frequent use of leaf-rust resistant varieties, and the absence of any great wheat tract to the southward.

A third trip over the same area was made at the end of May with Dr. H. A. Edson (P.D.R. 22: 179). At this time the wheat had begun to fill, and although most of the leaves were long since dead, the rust was indicating its presence by pustules on the glumes and awns, and its effect by the short, poorly-filled heads which were everywhere in evidence. Stem rust could be found without difficulty, but usually in very small amount.

If at this point the crop had matured at a normal rate, the rust damage might have been even greater than it was. But the spring rains continued into June, and harvest was consequently delayed. During this extended period the stems, glumes, and awns were able to contribute toward the filling of the grains, and to a small extent compensate for the early loss of the leaves. The rains also served as a deterrent to farmers who sometimes have a tendency to harvest earlier than is necessary.

Letters to the Plant Pathology Department, which had become less frequent during the early heading stage, were now again received in quantity. They were mainly concerned with the reason for the small heads, poor fill, and shriveled grain in wheat which had looked so promising a short time before. In some cases growers inquired about the advisability of saving 1937 seed for planting the 1939 crop. (Many did so on their own initiative). Occasionally a letter was received requesting information on the safety of feeding rusted wheat to livestock. On two or three occasions wheat growers were disturbed because their wheat kernels were strikingly orange-discolored at the tip. The discoloration proved to be due to masses of leaf-rust uredospores which were entangled in the brush of the grains.

Varietal Susceptibility

An account of the behavior of wheat varieties with respect to the leaf-rust in 1938 is restricted to data available from county agents' and millers' reports, from inspection of the wheat variety plantings of the Oklahoma Agricultural Experiment Station, and from personal field observations, which latter were often limited by ignorance of the variety observed.

Of the major hard wheats grown in Oklahoma, Turkey and Blackhull were severely attacked, while Chiefkan gave evidence of considerable resistance. Tenmarq showed resistance in some localities. It was not fully resistant, and occasionally it was severely attacked, but on the whole it did not show the susceptibility of Turkey and Blackhull. The rust-resistance of Chiefkan should not be taken as a recommendation for its use, because Chiefkan has proved disappointing in other respects. Its appearance of high quality is deceptive, and it is not certified by Kansas or recommended by the Kansas Agricultural Experiment Station or the Oklahoma Crop Improvement Association. It is not considered acceptable from the milling and baking standpoints (5).

Among the soft wheats, Kawvale and Mediterranean (Bluestem) proved relatively resistant, while Red Cross and many other soft wheat varieties were severely attacked.

Through the kind cooperation of Professor C. B. Cross and Walter Chessmore, the following reactions, based on readings in the Stillwater Agronomy plots, have been made available. As they are taken from rather small plantings in a single locality, they are given as suggestions rather than as final.

Resistant Varieties	Moderately Resistant	Moderately Susceptible	Highly Susceptible
Kawvale	Superhard	Defiance	Java
Iowin	Golden Cross	Turkey	Mammoth Red
Sherman	Nittany	Pilcraw	Purplestraw
Marvel	V.P.I. 131	White Federation	Rice
Red Russian	Valley	Bunyip	Cheyenne
Currawa	Ghirka	Onas	Surprise
White Winter	New Zealand	Eaton	Oregon Zimmerman
Wilhelmina	Lofthouse	Prohibition	Rink
Wisconsin Pedigree #2	Quality	Blackhull	Touse
Chiefkan	Greeson	Converse	Early Defiance
	Martin	Red Indian	Fulcaster
	Eagle Chief	Forward	Little Club
	Yogo	Prosperity	
	Pacific Bluestem	Walker	
	Early Blackhull	Leap	
	Harvest Queen	Purkof	

Other Factors Affecting the 1938 Crop

An analysis of the various factors influencing yield and quality of any crop in any year, is at best the weighed opinion of those who have carefully studied the crop in its development. This was particularly true as respects the Oklahoma wheat crop of 1938, where the factors were intense and sometimes diametrically opposed in their influence on the crop. Some of these factors are measurable. We can calculate with fair accuracy the damage due to hail, to smuts, or to army worms. Losses from leaf rust can be estimated with reasonable accuracy by reference to the measurements that were developed in the work of Caldwell et al., and of Johnston and Miller (1, 3). The effects of other factors, such as excess moisture, long-postponed after-effects of frost, and late attacks of stem rust are more conjectural.

The meteorological factors influencing the 1938 crop were primarily growing temperatures, frost, moisture, and hail. As regards growing temperatures, these were in the main beneficial to wheat growth. Temperatures in the vicinity of 65° F., favorable for wheat development, were reached early in the season and sustained throughout the greater part of the spring. With regard to hail, figures for the injury to wheat alone are not available, but the total hail injury to crops in the spring of 1938 amounted to $1,563,000 as compared with $1,801,700 for 1937[5/], which is not excessively high.

5/ See footnote 2, page 2.

The spring precipitation, which is often the limiting factor in Oklahoma wheat production, was ample, in most of the State, for successful wheat development. It was not excessive as measured against the optimal requirements for wheat growth, except as it affected the wheat diseases, delayed the harvest, or caused local flooding of low fields. The effect of the late spring frosts was largely a temporary set-back, although permanent injury to the heads of Early Blackhull wheat was evident, especially in the southwestern counties. These various meteorological factors are discussed in their relation to yield reduction on pages 15 to 17.

With regard to the effects of insects on the 1938 wheat crop, the principal features of the season were (a) a severe local infestation of brown mites in the extreme southwestern counties, (b) an abortive outbreak of grasshoppers which failed to be as destructive as was anticipated, (c) generally scattered infestations of army worms, (d) numerous local infestations of the green bug in the early spring, which were checked by rising temperatures in April, (e) a light infestation of stem maggots, which were found at many points over the State but never over 1 percent in the fields, and (f) an increasingly important attack of the wheat white grub especially in the northern counties. Of all these, the army worms were most destructive. At the time of their greatest activity the wheat leaves had been largely destroyed by rust, and hence their attack was directly on the heads, which accentuated the damage. All in all, the losses in wheat from insect depredations in 1938 were no greater, and possibly less than in an average year.

Dr. F. A. Fenton, Oklahoma State Entomologist, after reading the foregoing paragraph has kindly consented to add the following comments on the entomological aspects of the 1938 wheat crop:

> "Your summary of wheat insect conditions for Oklahoma is correct. According to Mr. Stiles' grasshopper report, I have the following figures on the wheat crop: 134,249 acres damaged. Loss in dollars - $598,439.96. Acres protected - 585,305. Savings in dollars $2,363,746.18. This is the report which Mr. Stiles has compiled from a questionnaire sent to county agents.
>
> "The wheat white grub, Phyllophaga lanceolata, caused many hundreds of acres of wheat to be replanted to this or other crops. In most cases the wheat was destroyed as many times as it was replanted. Where it was felt that there was enough wheat left so that replanting was not necessary, such fields were usually undisturbed but the grubs continued their work so that there was an important crop reduction, the extent of which we have been unable to determine."

The principal diseases affecting the 1938 wheat crop, apart from leaf rust which overshadowed all others, were bunt [Tilletia spp.], loose smut [Ustilago tritici], and stem rust. According to the Federal Grain Market Inspection (6) bunt was less prevalent in Oklahoma in 1938 than in 1937. Loose smut was everywhere in evidence (P.D.R. 22: 206) with an average loss for the State of about 2.5 percent. This does not appear to represent a significant change from 1937 or earlier years. Slight amounts of basal glume rot [Bacterium atrofaciens], foot-rots, speckled leaf blotch [Septoria tritici], Helminthosporium infections, scab [Gibberella saubinetii], and mosaic [virus] were observed, but none of these was a yield factor of importance. Stem rust appeared in traces at heading time. By harvest it was fairly prevalent, but appeared to be a yield factor in only exceptional cases. (P.D.R. 22: 180. See also discussion on page 15 following).

Lodging was fairly frequent, due in some cases (mainly in the early wheat of the southwestern counties) to frost injury, in other cases to delayed harvest as a result of June rains, and in many cases to weakness of the straw as a result of the starved condition following the loss of leaves from leaf-rust.

The Yield

The average Oklahoma wheat production for the 11-year period from 1927-1937 was 46,000,000 bushels. This includes several years of drought. The 1937 production was 65,462,000 bushels from 4,610,000 acres harvested, an average yield of 14.2 bushels per acre. In 1938 the production was 58,993,000 bushels, or an average of 11.0 bushels per acre. The 1938 yield was thus 22.5 percent less than in 1937 on an acreage basis. It was below the average yield per acre for 1927-1936, which includes the drought years.

Not only was there a decline in the amount of the production, but a further loss resulted from a lowered quality of the 1938 wheat. The Federal Grain Inspector's office at Enid reports on the 1938 crop as follows (6): "The test weight and appearance of the Hard Red Winter wheat of Oklahoma is below that of the past few years. The average test weight is about 57.7 pounds as compared to 59.7 to 60.2 pounds in past years."

Additional evidence on the yield and quality of the 1938 crop was obtained directly from the farmers by means of a questionnaire distributed by county agents in June. Typical reports from a few of the more important wheat-producing counties are given in Table 1, complete and in the exact form received, except that the growers' names are omitted.

The outcome of threshing returns is brought out in the following items from local Oklahoma newspapers:

"Farmers in the Enid wheat belt, harvesting as little as three bushels per acre from fields that looked as if they would produce thirty bushels, predicted today the Oklahoma wheat crop would fall far short of the government's June 1 estimate."

"Harvest returns from the southwest continued disappointing in some sections, Enid millers suggesting the Oklahoma crop would fall 30,000,000 bushels or more below the recent government estimate of 72,000,000."

"There are no well-filled wheat heads this year. Some are empty at the bottom, and others at the top, and some have no grains at all. Wheat is testing between 45 and 61 pounds."

"From Fairview, comes excressions from farmers that 'Our wheat is not half as good as we were thinking it was'. Grain is shriveled and light in weight, it was reported in that area."

The price of wheat, in its continual decline since the dollar-a-bushel level for the 1937 crop, was twice temporarily raised, once when the rapid development of rust was first apparent, and again on news of the disappointing threshing returns in the southwest. But the forces determining the price of wheat in 1938 were not entirely related to production, and the unexpected losses in the United States winter crop could have no more than a transient superficial effect on the price.

Leaf Rust as a Factor in the 1938 Yield Reduction

During the earlier part of the growing season of 1938 there was every indication of a most bountiful harvest. Moisture and temperature were favorable; the acreage was large. This was reflected in the optimistic wheat yield predictions for Oklahoma which ran as high as 77,000,000 bushels. The Oklahoma all-time high is 74,000,000. The leaf-rust infection caused the Oklahoma Agricultural Experiment Station to inject a note of conservatism into this picture in April, with an estimate 30 percent under the more optimistic predictions, but even as late as June 6, at the threshold of harvest, official estimates were still running as high as 72,500,000. The actual yield was 58,993.000 bushels of low quality wheat.

This unexpected result necessitated interpretation, particularly on the part of the sponsors of the higher estimates. The theories advanced were numerous and varied. To one crop scout the lowered yield was due to "root-exhaustion and rot". To another it was "frost and poor foundation conditions". A third attributed it to "freeze and stem rust and continued rains". A fourth considered it due to "subsoil dryness". A fifth, on April 27 held that "neither stem rust nor orange rust will be of much consideration", although on June 20 he reported "serious retrograding from shallow rooting and orange rust". A local agronomist felt that insects

Table 1. Representative Farmers' Reports on the 1938 Wheat Crop.

	County	Location of field	Upland or Bottom	Wheat Variety	Yield in 1938	Yield in 1937	Test weight in 1938	Test weight in 1937	Growers' Comment
1.	Blaine	Eagle City	Both	Early Blackhull	5	25	54	60	Lots of rust. Lots of shriveled grain.
2.	"	Geary	Upland	Superhard Blackhull	6	20	53	60	Lots of rust. Lots of shriveled grain.
3.	"	Watonga	Upland	Superhard Blackhull	11	21	53	60	Lots of rust. Lots of shriveled grain.
4.	"	Watonga	Upland	Tenmarq	35	First Year	58	--	Very little rust. Not shriveled.
5.	"	Watonga	Bottom	Tenmarq	30		58	--	Very little rust. Not shriveled.
6.	"	Watonga	Bottom	Superhard Blackhull	12	28	53	60	Lots of rust. Lots of shriveled grain.
7.	"	Omega	Upland	Superhard Blackhull	10	12	56	60	Lots of rust. Lots of shriveled grain.
8.	"	Omega	Upland	Tenmarq	22	1st yr.	58	--	Very little rust. Not shriveled.
9.	"	Eagle City	Upland	Chiefkan	20	21	60	60	Very little rust. Not shriveled.
10.	"	Eagle City	Upland	Early Blackhull	12	21	55	60	Lots of rust. Shriveled.
11.	Garfield	Drummond	Upland	-----	11	22	57	63	Leaf rust, shriveled kernels, some hail, and too much moisture on flat land.
12.	"	Hunter	Upland	-----	10.5	18	56	59	Plenty of rust. 8.3% hail.
13.	"	Carrier	Upland	Blackhull	4	28.5		60	Leaf rust, some smut, worms, late freeze, too much rain.
14.	"	Garber	Upland	-----	8	17	57	60	Rust and grubs.
15.	"	Garber	Bottom	-----	15	18	54	60	Rust.
16.	"	Kremlin	Upland	Turkey	11	17.5	56-58	60	-----
17.	"	Carrier	Upland	Tenmarq	8	29	56-57	60	-----
18.	"	Marshall	Upland	-----	12	15	59	60	Some rust and lodging.

	County	Location of field	Upland or Bottom	Wheat Variety	Yield in 1938	Yield in 1937	Test Weight in 1938	Test Weight in 1937	Growers' Comment
19.	McClain	Byers	Upland	Hard Winter	10	18	59	61	Trace of leaf rust. Yellow berries.
20.	"	Newcastle	Upland	Hard Winter	20	30	59	61	Yellow berries. Leaf rust.
21.	"	Newcastle	Upland	Hard Winter	21	30	60	61	Yellow berries. Leaf rust.
22.	"	Newcastle	Upland	Hard Winter	14	20	60	61	Leaf rust and yellow berries.
23.	"	Newcastle	Upland	Hard Winter	30	30	61	62	Leaf rust.
24.	"	Newcastle	Upland	Hard Winter	25	32	54	60	Leaf rust.
25.	"	Newcastle	Upland	Hard Winter	25	39	59	61	Leaf rust.
26.	"	Purcell	Bottom	Hard Winter	31	38	60	62	Leaf rust, army worms.
27.	"	Newcastle	Upland	Hard Winter	16	18	58	60	Yellow berries, rust.
28.	"	Goldsby Store	Upland	Hard Winter	17	32	54	60	Yellow berries, rust.
29.	Canadian	29-14-9	Upland	Turkey Red	12	21	59	60	Leaf rust and stem rust damage. No worms.
30.	"	Heaton Com.	Upland	Tenmarq	17	25	58	60	Rust damage.
31.	"	22-14-9	Upland	Blackhull	16	21	60	58	Down in top joint. Leaf rust bad. Some stem rust.
32.	"	5-13-6	Upland	Tenmarq	15	18	60	58-61	Frost damage. No worms. Leaf rust.
33.	"	2-12-9	Upland	Fulcaster	16	18	59	60	Leaf rust and some stem rust. No worm damage.
34.	"	12-11-8	Upland	Fulcaster	16	15	58	63	Leaf rust, freeze damage, no stem rust, no worms.
35.	"	21-11-8	Bottom	Fulcaster	20	30	58	62	Leaf rust, freeze, stem rust, worms bad.
36.	"	7-12-6	Bottom	Unknown	18	20	58	60	Worms bad, leaf rust, stem rust, broke over.
37.	"	32-12-5	Upland	Turkey Red	9	16	59	60	Leaf rust bad, some stem rust, freeze, 30% damage.
38.	"	12-13-9	Bottom	Turkey Red	18	26	58	60	Worms bad, leaf rust bad, stem rust damage bad.

were the only major cause of lowered yields. Several authorities have cited as causes leaf-rust, stem rust, excess moisture, late harvest, insects, hail, and April freeze, without pointing out the relative importance of any of these. Of all, the explanations occurring most frequently are leaf-rust, April freeze, stem rust, and excess moisture. The year 1938 was an off-year for wheat insects, hail damage to crops in Oklahoma in 1938 was $238,700 less than in 1937[6], and the remaining factors suggested are too vague to be susceptible of analysis.

It is now possible to analyze these factors and gain some information on their relative rôles.

1. Leaf-rust. It has become apparent from observations and reports that in 1938 the best yields were generally those of the leaf-rust resistant varieties, and that the rust-susceptible varieties showed the poorer yields and quality of grain. This was particularly evident when resistant and susceptible varieties were grown on the same farm and subjected to the same conditions of temperature, moisture, soil, culture, hail, and insects. For example, in Table 1, reports 3 and 4, 5 and 6, 7 and 8, and 9 and 10 in each case were pairs of reports from the same farm.

The areas of poorest yield and quality of grain in 1938 were the areas of greatest leaf-rust infection, viz. from Grant County southward. The northwest area, where leaf-rust was latest and lightest, produced the best yields and quality of wheat in the State, although this area had its share of frost, hail, late rains, and army worms.

It has been shown in Kansas, Indiana, and elsewhere (1, 3, 4) that the removal of wheat leaves by leaf-rust has a definite and predictable effect in lowering the yield and quality of wheat, and that this effect is greater or less according as the infection takes place at an early or late stage in the development of the wheat. These studies have shown experimentally that infection of susceptible wheats by leaf-rust at a time and to a degree comparable to those of the Oklahoma epidemic, has the following effects on the wheat: reduction of the yield from 30 to 50 percent or more; rapid and severe deterioration of the roots; reduction in test weight and in protein content of the grain; production of yellow berry; and in some cases shriveling of the grain. The yield reduction results from the production of shorter heads with fewer and smaller kernels. On this experimental basis it was possible to predict in late April that the Oklahoma crop would show the foregoing results, and the appearance of the plants and grain at harvest time was a faithful and fully-detailed expression of these same effects.

6/ See footnote 2, page 2.

2. Stem-rust. A number of surveys have shown that although stem-rust arrived early, it did not become well established in Oklahoma until harvest time, and that except in rare cases it was not a major factor in yield. (Cf. P.D.R. 22: 180). Reports compiled from the summaries of the Bureau of Entomology and Plant Quarantine, and the "Cereal Courier" (P.D.R. 22: 285) estimate the Oklahoma damage from stem-rust in 1938 at 2 to 5 percent of the crop. The average farmer does not distinguish leaf-rust from stem-rust. To him leaf-rust is "red-rust" and is harmless; stem-rust is "black-rust" and is dangerous. Oklahoma wheat fields were filled with "black rust" at harvest time, but it was the black telial stage of the orange leaf-rust, and not a destructive amount of black stem-rust. This misconception often extends beyond the farmer to professional agriculturists. The "stem rust" or "black rust" reported here and there in Table 1 is undoubtedly the telial stage of leaf-rust in some or many of the cases, judging by personal experiences in the farmer's diagnosis of his wheat rusts.

Moreover, it is the tendency for an observer to judge the causes of crop loss in terms of the conditions existing at the time the damage is noted. Leaf rust did its destructive work in Oklahoma in April and May, although the damage was not to show until harvest. Much later, the stem-rust appeared, and since it was on the scene at the inquest, it was indicted.

3. Frost injury. The sub-freezing temperatures of the first week of April caused frost injury which was a yield factor in some parts of the State, notably in the southwestern counties. The injury appears to have been limited to Early Blackhull, the only variety which was approaching maturity at the time of the frost. Comparatively little of the wheat in the State had jointed by early April. The injury in the Early Blackhull took the form of sterility in the heads, and in some cases the straw was injured.

A condition that was common in Oklahoma wheat in 1938 was a darkening of the nodes. This was observed in many parts of the State, and to a large extent around Woodward in the northwest, where leaf-rust was light, and yields were the highest in the State. It occurred in both high-yielding and low-yielding wheats, and its presence was not correlated with yield. In fields where lodging occurred, the stems commonly broke over at the green internodes and not at the darkened nodes. In this respect the trouble appears to differ from the similar condition described by Creager in Kansas (P.D.R. 22: 242). Sections through the blackened nodes indicated that the trouble was mainly superficial, and that neither conduction nor strength of the straw appeared to be affected. This condition was probably an after-effect of the late frost, but it appears that it had little or nothing to do with the yield except in the southwestern counties, where the frost injury on the early wheat was most pronounced, and where the straw above the blackened nodes was blanched and dried.

An examination of the weather record (7) shows that the lowest temperatures during the April freeze were in the northwestern counties (Woodward County 20°-22°, Ellis County 21°, Beaver County 22°, Dewey County 20°, etc.), while the central wheat counties suffered less extreme temperatures (Grant County 24°, Garfield County 22°-27°, Kingfisher County 25°-26°, Canadian County 26°, Noble County 28°, Kay County 26°, etc.). Yet it was the northwestern counties that produced the highest yields and the central counties that suffered the more serious losses during 1938.

The type of heads and fill, as they were generally observed over the greater part of the State, presented the characteristics of slow starvation, rather than the blocking out of sterile portions in an otherwise normal head, such as follows frost injury. There would be one or two kernels to a brush, evenly over the heads, rather than two or three or sometimes four, such as Oklahoma wheat normally shows. The grains themselves would be small and light, and this property also would be evenly distributed through the heads.

It is noteworthy that yield reduction in 1938 was neither restricted to the early wheats, nor most prominent in these. As is seen in Table 1, Turkey, and other midseason wheats which were not past the tillering stage in early April, show the same poor yields as Early Blackhull. This would not be expected if frost injury was the principal cause for yield reduction.

A consideration of the foregoing points leads one to the conclusion that the April freeze was not the major factor in wheat yield and quality reductions in 1938. It undoubtedly played an appreciable part in such reductions, and in Early Blackhull wheat in the southwestern counties it may have been one of the most important yield factors, but it is not believed that this is true of the State crop generally. There has been a quite natural tendency to regard the freeze as the one important yield factor, especially on the part of crop reporters who committed themselves to a disregard of the rust potentialities earlier in the season.

4. Precipitation. The accumulated rainfall from January 1 to June 30, 1938 in Oklahoma amounted to 23.38 inches as compared with a 50-year average of 16.86 inches for the same period. While this represents an exceptionally heavy precipitation for the State it is still within the range which will permit favorable wheat growth. This moisture was fairly evenly distributed over the 6-month period. The effects of the moisture as a yield factor were exerted in opposite directions. On the one hand, it was ample to permit rapid, vigorous growth, and in this respect it was beneficial to production. On the other hand, it acted as a factor in decreasing production, generally by permitting the succulent growth and moist environment conducive to rust development, and locally by flooding or delaying the harvest.

Table 1 illustrates the common observation in 1938 that upland wheat shared to a major extent in the crop reduction. It has also been noted that leaf-rust-resistant and leaf-rust-susceptible wheats showed high and low yields respectively even when exposed to similar moisture conditions. The acreage actually involved in flooding or harvest-time water damage represented a relatively small part of the total wheat acreage.

The spring precipitation as a direct factor in wheat production was far more of a benefit than a calamity. Indirectly the reverse was true: it permitted the leaf-rust epidemic to occur, with its consequent reduction of yield, which was only partly compensated for by the vigorous growth of the wheat. (Cf. C. O. Johnston: "The leaf-rust loss probably will be underestimated owing to favorable moisture conditions which will raise the general yield level." P.D.R. 22: 180).

Conclusion

From the foregoing analysis it is concluded that the leaf-rust was the major reason for the 25 to 30 percent reduction in yield and quality of the 1938 wheat crop in Oklahoma. This conclusion is consistent with the findings of various cereal disease specialists who have studied the crop in the Southwest, and with the estimates of losses from leaf-rust as the disease followed the crop northward from Texas to the Dakotas and Canada (P.D.R. 22: 157, 176, 180, 243, 244, 369, 371).

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Appendix: Statistics of the 1938 Oklahoma Wheat Crop.

Weather Record.

	Temperature		Precipitation		Crop damage from hail	
	1937/38	Normal	1937/38	Normal	1938	1937
November	46.8	49.8	1.59	2.01		
December	38.7	39.8	1.54	1.69		
January	42.2	38.3	1.44	1.43		
February	46.4	41.0	4.45	1.37		
March	58.1	50.8	4.25	2.21	$ 97,000	$ 3,000
April	59.4	60.3	2.88	3.32	10,000	
May	68.8	68.3	5.95	4.73	741,000	293,100
June	77.1	77.3	4.37	3.80	715,000	1,505,600
					$1,563,000	$1,801,700

Production.

	1938	1937	1927-1936*
Production, in bushels	58,993,000	65,462,000	45,965,000
Acreage harvested	5,363,000	4,610,000	
Yield in bushels per acre	11.0	14.2	11.2
Market value of crop, per bushel	$.50	$1.18-$.92	
Wheat income	$29,486,000	$65,000,000	
Yield per acre, 1938 as compared with 1937	77.5%		
Test weight, in pounds per bushel	57.7	59.7-60.2	

*Includes several drought years.

Fig. 2. County map of Oklahoma, indicating the distribution of leaf-rust and other yield factors in 1938.

1937 AND 1938 ADDITIONS AND CORRECTIONS TO THE LIST OF CAUSES OF FUNGOUS AND BACTERIAL PLANT DISEASES IN MAINE

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Plant Disease Reporter
Supplement 113

September 5, 1939

Since the publication of "List of causes of fungous and bacterial plant diseases in Maine to 1936 inclusive", Plant Disease Reporter Supplement 105, 1938, many additional organisms have been recorded and the distribution of several diseases within the State has been extended. In connection with a research project initiated by the senior author, an attempt has been made to record the fungi found attacking hardwood trees, particularly birch, beech, maple, and oak. P. L. Ricker, of the Division of Forage Crops and Diseases, U. S. Bureau of Plant Industry, has very kindly sent a list of unpublished additions to, and corrections of, his "Preliminary list of Maine fungi," University of Maine Studies, No. 3, 1902.

This list follows the same procedure as Supplement 105. Citations marked with an asterisk (*) are from Ricker only. The other sources from which this list has been compiled are indicated by key letters, as in Supplement 105, whose meanings are as follows:

C = card in the file of disease records of the Department of Plant Pathology of the Maine Agricultural Experiment Station.

H = herbaria of the Department of Botany, University of Maine, and of the Department of Plant Pathology of the Maine Agricultural Experiment Station (reference to this herbarium was omitted in Supplement 105), and private herbaria of interested botanists at the University.

L = a letter, or other correspondence

P = Plant Disease Reporter, or supplements and special reports of the Plant Disease Survey as indicated.

After each scientific name of an organism there are given the sources of information as noted above; the first known date of occurrence or report of the disease; and the county in which the collection was made, where this is known.

ABIES BALSAMEA (L.) Mill. FIR
    Aleurodiscus amorphus (Pers.) Rabh. H 1938 Penobscot.
    Rehmiellopsis bohemica Bub. & Kab. P 1937.

ACER sp. MAPLE
    Hymenochaete corrugata (Fr.) Lév. H 1937 Penobscot.
    Phyllosticta sp. C 1938 Washington.
  * Polyporus fumosus (Pers.) Fr. (Bjerkandera puberula, Polyporus fragans of R.) 1909 Hancock.

ACER NEGUNDO L. BOX ELDER
    Coryneum negundinis Berk. & Curt. P 1937.

ACER RUBRUM L. RED MAPLE
    Hymenochaete corrugata (Fr.) Lév. H 1938 Penobscot.
    Ustulina vulgaris Tul. H 1938 Penobscot.

ACER SACCHARUM Marsh. SUGAR MAPLE
    Panus rudis Fr. H 1938 Penobscot.
    Pleurotus serotinus (Schrad.) Fr. H. 1938 Penobscot.

ALNUS sp. ALDER
    Crepidotus calolepis Fr. H 1938 Penobscot.
    Fomes scutellatus (Schw.) Cke. H 1938 Penobscot.
    Polyporus adustus (Willd.) Fr. H 1937 Penobscot.
    Polyporus dichrous Fr. H 1937 Penobscot.

ALNUS INCANA (L.) Moench. HOARY ALDER
    *Odontia rimosissima Pk. instead of Kneiffia setigera Fr.

AMELANCHIER CANADENSIS (L.) Medic. SHADBUSH
    Gymnosporangium clavariaeforme (Jacq.) DC H 1938 Penobscot.

AMELANCHIER LAEVIS Wiegand
    Gymnosporangium biseptatum Ell. H 1937 Penobscot, Knox.
    Gymnosporangium clavariaeforme (Jacq.) DC H 1938 Penobscot.

AMELANCHIEER SANGUINEA (Pursh) DC
    Gymnosporangium biseptatum Ell. H 1938 Penobscot.

AMELANCHIER STOLONIFERA Wiegand
    Gymnosporangium biseptatum Ell. H 1937 Penobscot.

ASTILBE sp.
    Sphaerotheca castagnei Lév. C 1938 Penobscot.

BEGONIA sp. BEGONIA
    Botrytis sp. C 1938 Hancock.

BETULA sp. BIRCH
Phlebia merismoides Fr. H 1937 Penobscot.
Taphrina betulina Rostr. C 1938 Franklin.

BETULA LUTEA Michx. f. YELLOW BIRCH
Taphrina sp. P 1937.

BETULA PAPYRIFERA Marsh. WHITE BIRCH
Polyporus albellus Peck. H 1937 Penobscot.
Polyporus pargamenus Fr. H 1938 Penobscot.
Polyporus radiatus (Sow.) Fr. H 1938 Penobscot.

BETULA PAPYRIFERA Marsh. var. CORDIFOLIA Fern.
Fomes applanatus (Pers.) Wallr. H 1938 Piscataquis.
Fomes fomentarius (Fr.) Kickx. H 1938 Piscataquis.
Pleurotus serotinus (Schrad.) Fr. H 1938 Piscataquis.
Polyporus pargamenus Fr. H 1938 Piscataquis.
Polyporus radiatus (Sow.) Fr. H 1938 Piscataquis.
Poria laevigata (Fr.) Sacc. H 1938 Piscataquis.

BETULA POPULIFOLIA Marsh. GRAY BIRCH
Daedalea unicolor (Bull.) Fr. H 1937 Penobscot.
Hymenochaete corrugata (Fr.) Lév. H 1938 Penobscot.
Polyporus adustus (Willd.) Fr. H 1938 Penobscot.
Polyporus albellus Peck. H 1937 Penobscot.
Polyporus hirsutus (Wulf.) Fr. H 1938 Penobscot.
Polyporus radiatus (Sow.) Fr. H 1938 Penobscot.
Polyporus velutinus Fr. H 1937 Penobscot.
Poria subacida Peck. H 1937 Penobscot.
Stereum purpureum (Pers.) Fr. H 1937 Penobscot.

BRASSICA PEKINENSIS Rupr.
Alternaria brassicae (Berk.) Sacc. C 1937 Maine.

CHAMAECYPARIS THYOIDES (L.) BSP. WHITE CEDAR
Gymnosporangium fraternum Kern (G. transformans (Ell.) Kern) H 1937. Knox

CRATAEGUS sp.
Gymnosporangium globosum Farl. H 1938 Lincoln.

CUCURBITA MAXIMA Duchense SQUASH
Erwinia tracheiphila (EFS) Holland. C 1938 Franklin.
Fusarium sp. C 1938 Kennebec, Androscoggin.

DAUCUS CAROTA L. CARROT
Cercospora apii Fr. var. carotae Pass. C 1938 Cumberland, York.
Macrosporium carotae Ell. & Langlois. C 1938 Cumberland, York.

FRAXINUS sp. ASH
Ustulina vulgaris Tul. H 1938 Penobscot.

JUNIPERUS HORIZONTALIS Moench.
Gymnosporangium corniculans Kern. H 1938 Hancock.
Gymnosporangium globosum Farl. H 1938 Lincoln.
Gymnosporangium nidus-avis Thax. H 1937 York.

LYCOPERSICUM ESCULENTUM Mill. TOMATO
Cladosporium fulvum Cke. C 1938 General.

OSTRYA VIRGINIANA (Mill.) K. Koch. HOP HORNBEAM
Stereum purpureum (Pers.) Fr. H 1938 Penobscot.

PELARGONIUM sp. GERANIUM
Botrytis sp. C 1938 Somerset.
Phytomonas pelargoni (Brown) Bergey et al. C 1938 Cumberland.

PHALARIS ARUNDINACEA L. REED GRASS
*Puccinia sessilis Schneid. 1903 Somerset.

PHASEOLUS VULGARIS L. BEAN
Phytomonas medicaginis var. phaseolicola Burk. C 1938 General.

PICEA sp. SPRUCE
Dimerosporium sp. C 1938 Hancock.
Lenzites trabea (Pers.) Fr. H 1937 Penobscot.

PICEA RUBENS Sarg. RED SPRUCE
Cytospora kunzei Sacc. P 1937.
*Fomes roseus (A. & S.) Cke. 1903 Penobscot.
Lenzites trabea (Pers.) Fr. H 1938 Piscataquis.
*Polyporus cuticularis (Bull.) Fr. (Inonotus perplexus) 1903 Penobscot.

PISUM SATIVUM L. PEA
Fusarium coeruleum (Lib.) Sacc. L 1938 Penobscot.
Fusarium martii Appel & Woll. var. pisi Jones. L 1938 Penobscot.
Peronospora viciae (Berk.) DBy. C 1938 Somerset.
Rhizoctonia sp. C 1938 Penobscot.

POPULUS sp. POPLAR

Exidia glandulosa (Bull.) Fr. H 1937 Penobscot.
Lenzites trabea (Pers.) Fr. H 1937 Penobscot.
Panus rudis Fr. H 1937 Penobscot.
Phlebia strigosa-zonata (Schw.) Burt. H 1937 Penobscot.
Polyporus albellus Peck. H 1938 Penobscot.
Polyporus pargamenus Fr. H 1938 Penobscot.
Trametes trogii Berk. (T. morgani Lloyd) H 1937 Penobscot.

PRUNUS sp. CHERRY

Coccomyces sp. C 1938 Androscoggin.

PRUNUS PENNSYLVANICA L. f. PIN CHERRY

Poria prunicola (Murr.) Sacc. H 1938 Piscataquis.

PYRUS MALUS L. APPLE

Pezicula malicorticis (Cord.) Nannf. C 1938 General.
Pezicula malicorticis (Cord.) Nannf. var. perennans (Zeller & Childs) Kienholz C 1938 Kennebec, Androscoggin.
Polyporus adustus (Willd.) Fr. H 1938 Penobscot.

QUERCUS ALBA L. WHITE OAK

*Pestalozzia monochaeta Desm. 1903 Oxford.

QUERCUS BOREALIS Michx. NORTHERN RED OAK

Irpex cinnamomeus Fr. H 1938 Penobscot.
Lenzites betulina (L.) Fr. H 1938 Penobscot.
Panus stipticus Bull. H 1938 Penobscot.
Polyporus albellus Peck H 1938 Penobscot.
Polyporus cinnabarinus (Jacq.) Fr. H 1938 Penobscot.
Polyporus dichrous Fr. H 1938 Franklin.
Polyporus hirsutulus Schw. H 1938 Penobscot.
Polyporus hirsutus (Wulf) Fr. H 1938 Penobscot.
Stereum rameale Schw. H 1937 York, Penobscot.
Taphrina coerulescens (D. & M.) Tul. C 1938 Maine.

ROBINIA PSEUDO-ACACIA L. LOCUST

Pleurotus sp. H 1938 Penobscot.
Poria sp. H 1938 Penobscot.

ROSA sp. ROSE

Phytomonas tumefaciens (EFS & Town.) Bergey et. al. C 1938 Androscoggin.
Sphaerotheca pannosa (Wallr.) Lév. C 1938 Penobscot.

RUBUS IDAEUS L. COMMON RED RASPBERRY
Didymella applanata (Niessl) Sacc. C 1938 Androscoggin.

RYNCHOSPORA ALBA (L.) Vahl. BEAK RUSH
*Cintractia montagnei (Tul.) Magn.

SALIX sp. WILLOW
Daedalea confragosa Pers. H 1938 Penobscot.

SOLANUM TUBEROSUM L. POTATO
Phytophthora erythroseptica Pethyb. P 1938.

SORBUS DUMOSA Green
Gymnosporangium aurantiacum Chev. H 1938 Penobscot, Hancock.

SPIRAEA VANHOUTTEI Zabel
Xylaria polymorpha (Pers,) Grev. H 1938 Penobscot.

THUJA OCCIDENTALIS L. WHITE CEDAR
*Pestalozzia conigena Lév. 1900 Penobscot.

TSUGA CANADENSIS (L.) Carr. HEMLOCK
*Corticium roseum Pers. 1903 Cumberland.
Panus stipticus Bull. H 1938 Penobscot.
Schizophyllum commune Fr. H 1938 Penobscot.

ULMUS AMERICANA L. AMERICAN ELM
Fomes fomentarius (Fr.) Kickx H 1937 Penobscot.
Pleurotus sapidus (Kalchbr.) Sacc. H 1938 Oxford.
Pleurotus ulmarius (Bull.) Fr. H 1938 Penobscot.

ULMUS GLABRA Huds. var. PENDULA Rehd.
Pleurotus ulmarius (Bull.) Fr. H 1938 Penobscot.

ULMUS PARVIFOLIA Jacq. CHINESE ELM
Nectria cinnabarina (Tode) Fr. C 1938 Penobscot.

ZEA MAYS L. CORN
Rhizoctonia sp. C 1938 Franklin.

ZEA MAYS L. var. EVERTA Bailey POP CORN
Cladosporium sp. C 1937 Androscoggin.

ZIZANIA AQUATICA L. var. ANGUSTIFOLIA Hitchc. WILD RICE
Claviceps sp. H 1938 Penobscot.

FRUIT AND VEGETABLE DISEASES ON THE CHICAGO MARKET IN 1938

By G. B. Ramsey, Senior Pathologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Chicago, Illinois

Plant Disease Reporter
Supplement 114 September 15, 1939.

As in years past, these data were compiled from notes made on inspections of fresh fruits and vegetables as they arrived on South Water Market and at freight and express terminals, and from material abstracted from federal inspections certificates issued by the Bureau of Agricultural Economics in Chicago. The most important common diseases are listed as a matter of general information. Several unusual diseases observed on this market for the first time are also described. These diseases are phytophthora rot of California asparagus; waxy breakdown of California garlic; smudge and black rot of Texas Crystal Wax onions, and gray mold rot of California potatoes. Some field and market notes on the fall crop of California tomatoes are appended.

APPLES:

Blue mold rot (Penicillium expansum) as usual, was the most common cause of decay in apples from all regions. In the better grades of apples it is seldom that as much as 3 percent of blue mold rot is found, but in poorer grades it is not uncommon to find 5 to 15 percent and sometimes it ranges to as high as 50 percent. For example, a car of Idaho Winesaps in baskets was received in February which showed blue mold rot ranging from 15 to 55 percent, the average for the load being 30 percent.

Bitter rot (Glomerella cingulata) was observed on only one or two lots of Greenings received from Virginia in August. This decay ranged from 2 to 8 percent with an average of approximately 4 percent, mostly in the early stages of development.

Brown rot (Sclerotinia fructicola) is not commonly found affecting apples on the market, but this year it occurred in some Willow Twig apples from Missouri received the latter part of May. Four percent of the stock was affected with brown rot and there was also some slight decay caused by Alternaria.

Gray mold rot (Botrytis cinerea) was observed ranging from 2 to 10 percent in a car of Washington Winesaps received in June and a car of Rome Beauty also showed this decay ranging from 4 to 16 percent.

Bullseye rot (Gloeosporium perennans) was found affecting 10 percent of a lot of Washington Winesaps markted in July.

An unusual amount of Jonathan spot was found in a few cars of Washington fruit received in June. In one car in particular this blemish ranged from 15 to 70 percent, an average of about 45 percent of the fruit showed numerous small spots sometimes covering 40 percent of the surface of the fruit.

Pink mold rot (Cephalothecium roseum) following scab was noted affecting 1 to 2 percent of Greenings from New York in October.

Scald (non-parasitic) was not found affecting many apples seriously except in an occasional lot of Greening from New York, and Rome Beauty from West Virginia.

ARTICHOKES:

Only a few lots of globe artichokes from California were observed to show an appreciable amount of gray mold rot (Botrytis cinerea). One of the most serious marketing factors was discoloration of the outer scales due to rough handling. While the buds are under refrigeration and kept crisp there is not much discoloration apparent in bruised areas, but as soon as the buds become warm and the tissues begin to shrivel due to loss of water then the brownish-black discoloration becomes an objectionable feature.

ASPARAGUS:

Except for local stock most of the asparagus received on this market arrives during April and May from California. Most of this stock arrives in good condition, but occasionally cars show considerable decay, usually caused by bacteria of the soft rot type. Several cars inspected during the latter part of April and the first part of May showed bacterial soft rot ranging from 3 up to as high as 45 percent in some crates. The average for many lots was about 15 percent.

Fusarium species were evident as a mold on the tips of some lots of asparagus received from California in October. The most seriously diseased lot noted showed an average of 40 percent with moldy tips.

An unusual decay induced by a species of Phytophthora developed in asparagus shipped from excessively wet fields in California during March and April. Many lots showed this decay ranging from 10 to 30 percent. The spears were generally affected about an inch or two above the base. The decaying tissues were watery, soft, and slightly brown in color. Oospores were abundant i the grayish scum-like surface mold and in the broken down tissues.

BEANS:

Bacterial blight (Bacterium phaseoli) was found affecting 3 to 4 percent of the stock received from Florida, Illinois, and Arkansas in June.

Soil rot (Rhizoctonia) caused a great deal of damage to beans from Florida and Louisiana marketed in October. In a few cars over half of the stock in some hampers showed this decay. The average for the worst carlot noted was 12 percent.

Watery soft rot (Sclerotinia sclerotiorum) also caused considerable damage in some shipments of green beans from Florida and Louisiana.

CABBAGE:

Bacterial soft rot (Bacterium spp.) continues to be the most serious and the most common disease of cabbage on the market. While this decay usually affects only the outer leaves, it also occasionally becomes serious as a stump rot. In one lot of Missouri cabbage received in June 60 percent of the heads were infected. The decay was mostly at the butts and penetrated sometimes to a depth of one inch or more. This lot, of course, can not be considered typical, for it was loaded in bulk, the heads being approximately 5 feet deep in the car, and was shipped under ventilation. At the time of inspection the temperature of the cabbage at the bottom of the load was 75° and at the top of the load 89°F.

Black leaf speck (non-parasitic) seriously blemished some of the California stock received in February. One lot on inspection showed an average of 40 percent of the heads affected. This blemish is often very objectionable when the specks occur on the inner leaves of the head.

CANTALOUP:

Cantaloups received on this market were usually not seriously affected by decay. Some lots showed softening and withering and a few cars received in July showed 4 to 5 percent of the fruits affected with bacterial soft rot (Bacterium spp.). An occasional melon showed fusarium rot (Fusarium spp.) affecting the stem end.

CARROTS:

An unusual amount of watery soft rot (Sclerotinia sclerotiorum) was found on carrots on the market this season. Stock shipped from Texas during the middle of May showed a range of from 8 to 30 percent affected with this disease. The average for several cars was about 12 percent. Some California carrots received in October also showed 5 to 10 percent of watery soft rot.

One of the most serious market factors involving carrots was

bacterial soft rot (Bacterium spp.) in the tops. Several cars of Texas carrots received in March showed dirty tops with bacterial soft rot ranging sometimes as high as 50 percent.

CAULIFLOWER:

Bacterial soft rot (Bacterium spp.) caused considerable decay in several shipments received from California and New York. In California shipments received in March it often averaged around 6 percent. New York shipments received during October and November often showed as high as 25 percent of the heads affected with soft rot.

One car of New York stock showed approximately 50 percent of the heads affected with early stages of gray mold rot (Botrytis cinerea).

CELERY:

Blackheart occurred in small amounts in several shipments of Florida celery received in February, March, and April. The most seriously affected lot showed black-heart ranging from 12 to 50 percent, with an average of 30 percent.

Watery soft rot (Sclerotinia sclerotiorum) was rather serious in some of the California celery in April and May. A few shipments received here had as much as 75 percent of the stock affected.

CHICORY:

Shipments of curly endive or chicory received from California during February and March often showed considerable decay by bacterial soft rot (Bacterium spp.). However, one of the most serious marketing factors was a reddish-brown discoloration found in the heart leaves of a great many bunches. No organism is associated with this discoloration and it does not show in the field, hence it appears that it is due to some physiological disturbance at harvesting time or during refrigeration and transit.

CUCUMBERS:

Bacterial spot (Bacterium lachrymans) damaged many lots of cucumbers from Florida, Alabama, and South Carolina. This disease was especially prominent in South Carolina stock shipped in June when some cars had from 4 to 90 percent of the stock affected, the average for many being close to 25 percent.

Cottony leak (Pythium aphanidermatum) was found in small percentages in stock from both Florida and Alabama.

The most serious anthracnose (Colletotrichum lagenarium) found was in shipments received from Maryland in July. Several baskets of this stock inspected in a store showed an average of 40 percent seriously blemished.

Although most green-house stock is free from decay, withered ends occasionally detract greatly from the market value. A lot of cucumbers received from Washington in October showed an average of 60 percent with spongy and shriveled blossom ends involving almost one-fourth the length of the fruits.

Some Texas cucumbers received in May showed yellowish-brown lesions 1 to 2 centimeters in diameter, sometimes with green mold over the central region. The affected tissues were tough and spongy. Cavities filled with mold were common. A species of Alternaria was isolated from such lesions. Alternaria has been found affecting cucumbers on the market, but heretofore it has seemed to be secondary, following other diseases and injuries. In this instance, however, it seemed to be the inciting agent in the development of this yellowish-brown spongy rot.

DEWBERRIES:

Not many dewberries are inspected on this market. However, one shipment received by truck from North Carolina in May was found to have gray mold rot (Botrytis cinerea) affecting from 25 to 90 percent of the berries in some boxes, the average for the load being 50 percent.

GARLIC:

The most serious decay usually found in garlic on the market is blue mold rot (Penicillium spp.). In some lots inspected this decay averaged about 3 percent.

A yellow waxy breakdown of the outer cloves of bulbs from several lots proved more or less serious in California stock. These amber waxy cloves do not go into a soft decay, but eventually become dry and hard. No organism appears to be associated with this trouble. It has been suggested that high temperatures and possibly sunscald cause it.

GRAPES:

Gray mold (Botrytis cinerea) and blue mold (Penicillium) cause most of the decay in grapes on the market. In table grapes these diseases are usually not serious, but in wine grapes some lots were found to show as high as 90 percent infected.

Some grapes examined in February that were packed in sawdust containing sodium bisulphite showed considerable injury by this chemical.

GRAPEFRUIT:

Most of the serious decay in grapefruit was caused by blue mold (*Penicillium italicum*). While this decay ranged as high as 20 percent in some boxes, in a few cars, the average generally was close to 4 percent. This was especially true in the Texas stock received during January, February, and March. Shipments received later sometimes showed a higher percentage and these also showed a small amount of stem-end rot (*Phomopsis*).

LEMONS:

Green mold rot (*Pemicillium digitatum*) affected 3 percent of the lemons in one car of California stock received in May. This car also showed 1 percent of brown rot (*Phytophthora citrophthora*).

Alternaria rot (*Alternaria* spp.) in advanced stage associated with blue mold rot affected an average of 20 percent of the lemons received in a shipment from Texas in September.

LETTUCE:

Many shipments of lettuce received from Arizona and California showed bacterial soft rot (*Bacterium* spp.) in the outer leaves ranging from 2 to 25 percent. In California stock some of this decay was following tip burn (non-parasitic). Some cars of lettuce showed as much as 50 percent of the head affected with tip burn.

Downy mildew (*Bremia lactucae*) occurred in a few shipments of California stock received in April. Generally this disease affected 2 to 4 of the outer wrapper leaves, but since these are trimmed off there is usually little loss on account of this trouble.

A few shipments of California lettuce examined in September showed heads with internal brown spots, streaks, and yellowish areas indicating the presence of brown blight or spotted wilt.

ONIONS:

Gray mold rot (*Botrytis* spp.) was by far the most serious onion trouble on this market. The decay was prevalent in stock from Colorado, Idaho, Utah, Washington, California, Texas, and Wisconsin. A great many of the cars showed an average of 10 percent of this decay.

An unusual type of smudge or black spot was found on Crystal Wax onions from Texas in June. In one lot 25 percent showed black or grayish outer scales about the upper half of the bulbs. In many the fleshy scales about the neck were black. Definite black pycnidia were found on the discolored necks of several bulbs. An unidentified species of *Diplodia* was consistently isolated from these onions.

ORANGES:

Probably the most serious marketing factor in oranges was skin break-down characterized by pits and discolorations and shriveling about the stem ends of the fruit. Only in occasional lots of Florida stock was real stem end rot (Phomopsis) found.

Blue mold rot (Penicillium italicum) was present in many shipments from Florida and California, but generally ranged below 5 percent as an average.

PEACHES:

Brown rot (Sclerotinia fructicola) caused considerable decay in peaches from Arkansas, California, Georgia, and Illinois. This decay frequently averaged around 25 percent and sometimes some baskets showed as much as 80 percent decay. More brown rot was found in California peaches than has been noted for a number of years. In August some carlots had 12 to 60 percent, averaging 35 percent.

Rhizopus (Rhizopus nigricans) caused considerable decay in the fruit in the top layer baskets of some cars. It was generally present along with brown rot.

Colorado peaches received in September sometimes showed 15 percent of pustular spot (Coryneum beijerinckii).

PEARS:

Gray mold rot (Botrytis spp.) occurred in small percentages in a few lots of Oregon pears. This type of decay does not seem to be as common as in years past.

Brown rot (Sclerotinia cinerea) was found in only one truckload of Michigan stock received in September, affecting about 6 percent of the load.

Oregon pears in storage in May showed numerous brownish black circular spots, 1/4 to 1/2 inch in diameter, caused by a species of Cladosporium.

PEAS:

Gray mold rot (Botrytis spp.) caused more actual decay in peas than any other organism on this market. It was found in stock from California and Colorado. Usually less than 5 percent was noted, but in one lot received from Colorado in September 60 percent of the pods were affected with gray mold and watery soft rot (Sclerotinia sclerotiorum). As is common in other vegetable groups, these two diseases are frequently associated.

Of the defects noted, mosaic (virus) and scab (Cladosporium pisicola) were the most important, although pod spot (Ascochyta pisi) blemished some lots of California stock in April.

PEPPERS:

Rhizopus soft rot (Rhizopus nigricans) caused more decay of peppers on the market than any other organism. In some lots from 4 to 30 percent of the stock was affected. A lot of Georgia pimentos that were red ripe on arrival in April showed as much as 30 percent in some containers.

Bacterial spot (Bacterium vesicatorium) occurred in Florida peppers, but this blemish usually was not of sufficient importance to reduce the market value of the stock.

POTATOES:

Gray mold rot (Botrytis spp.) of potatoes on the market was found for the first time this year. Two carlots of California potatoes that arrived in January showed an average of 14 percent gray mold rot about half of which was in advanced stages. This rot was grayish-brown and watery, sometimes involving over half of the tuber. In advanced cases the characteristic surface mold bearing conidia was prominent and in a few instances sclerotia were present. Isolations made from a number of tubers gave pure cultures of Botrytis. Inoculation tests have proved the pathogenicity of the organism recovered.

Bacterial soft rot (Bacterium spp.) occurred in many lots of new potatoes that had been washed and not thoroughly dried before loading for shipment. Generally speaking, however, stock from Florida, Alabama, Louisiana and Texas is fairly well dried before packing; consequently the decay often does not run over 3 to 5 percent, with occasional lots running as high as 20 percent.

Sclerotium (Sclerotium rolfsii) occurred in small amounts in stock from Louisiana, Alabama and Arkansas.

Late blight tuber rot (Phytophthora infestans) affected 40 percent of the potatoes in a car of North Carolina stock received in June. Most of the other late blight found on the market came from Wisconsin in the October shipments, the decay sometimes ranging to as high as 20 to 30 percent.

California potatoes received in May and June often showed considerable brown discoloration at the bud end of the long White Rose potatoes shipped from the Shafter area. These tubers are especially tender at the bud end and are practically always scuffed, and somewhat discolored, especially if they have been exposed to hot winds for any length of time. In some instances there was an appreciable percentage of scald in this stock, and as usual, bacterial soft rot followed causing a sticky foul smelling decay

SWEET POTATOES:

Rhizopus soft rot (Rhizopus spp.) was about the only disease that caused serious trouble on this market. The Louisiana and Tennessee stock received here frequently showed up to 20 percent decay; the average was about 10 percent.

TOMATOES:

It was the writer's privilege to spend two weeks studying California tomato diseases in the fields and packing houses during the last of October. Instead of listing the diseases as in years past, it was thought that possibly many readers would be more interested in the field and market notes on California tomatoes which were compiled for the use of the Federal Inspection Service. These notes are given below.

WATERMELON:

There was a little more anthracnose (Colletotrichum lagenarium) and stem-end rot (Diplodia spp.) received on this market than has occurred in years past. The Florida stock received in May often had 3 percent stem-end rot, and the stock from Georgia arriving in July also showed 2 to 3 percent of this decay.

Anthracnose was particularly noticeable as a blemish in Georgia stock received in June and July. In one car the anthracnose spots were so numerous as to cover approximately half of the surface of some melons. Seventy percent of the melons in this car showed serious spotting.

Bruising is still one of the most serious troubles in shipping melons. It is not unusual to find from 5 to 50 percent of some loads badly damaged by bruising due to improper bedding and loading, or to shifting of the load during transit.

NOTES ON FIELD AND MARKET DISEASES OF CALIFORNIA TOMATOES
October 21 to November 3, 1938

ALTERNARIA ROT

Alternaria was found to be causing some leaf spot in many fields but was most severe in the Santa Maria district. This fungus was associated with some stem-end rot and decay following growth cracks and other injuries, but in most instances species of Macrosporium seemed to be more prominent. The decay frequently listed as alternaria rot during the latter half of the shipping season is usually due to Macrosporium.

ARSENICAL BURN

A rather peculiar type of fruit spot was observed in several fields. It was characterized by a definitely outlined dark brown to black slightly sunken area without external appearance of mechanical injury or fungous invasion. The affected tissue is firm and only skin deep. Most of the spots were on the shoulders of the fruit and vary from 1/8 to 1/4 inch in diameter. Tomatoes affected in this manner held for ripening usually have been found to show little or no decay. In each instance where this type of injury occurred it was found that the vines and fruits had been sprayed or dusted with some arsenical and this type of spotting did not occur prior to the application of the arsenical.

BLOSSOM-END ROT

Blossom-end rot was found in a few fields causing a slight amount of damage. Usually the affected fruits were readily discarded in the field and in the packing house so that ordinarily few diseased tomatoes of this type reach the market. There are two types of injury to the blossom end of the fruit: One shows as slightly sunken water-soaked, greenish-brown spots at or near the blossom end; the other as slightly discolored yellowish brown to brown areas that are smooth or frequently slightly raised. The sunken water-soaked spots may continue to enlarge during transit and ripening and in many cases a secondary decay induced by species of Alternaria or Macrosporium causes extensive decay by the time the tomatoes are ripe. The superficial brown type of spot does not seem to enlarge during transit and it is seldom subject to invasion by decay-producing organisms. When the fruits are full red ripe it is often difficult to see this brown scar-like blemish.

BUCKEYE ROT

This decay was found only in the northern district near Brentwood and Stockton. A small percentage was observed in the field and in one or two packing sheds.

CLADOSPORIUM ROT (Cladosporium herbarum)

This fungus does not affect the tomato vines or fruits seriously until the latter part of the growing season. It seems to be ever present, but usually as a saprophyte on dead leaves and stems and discarded ripe fruits. It becomes especially prominent when the tomato vines are wet with fog or rains. At the time such weather conditions occur there are usually many dead and dying tomato plants which have been partially killed by virus troubles such as mosaic, spotted wilt, and western yellow blight (curly top). Fruits underneath the vines that are kept moist by fogs or rain are often infected by Cladosporium and develop tan to brown circular spots varying in size from 1/8 to 1/2 inch in diameter. Older spots become black in the center with greenish-tan borders. The internal decayed

tissue is spongy and grayish-tan in color. This decay is not often prominent in the field or packing house, but it is frequently of considerable importance on the receiving market, especially in stock that is so green that it must be held in the ripening rooms for 10 days or more. The severe spotting, discoloration, and decay of the tomatoes in the Santa Maria district this fall was largely due to infections by Cladosporium, Macrosporium and Alternaria. Serious decay and spotting did not occur until after rains. As long as the surface of the tomato is dry, even though the spores of these organisms may be present there is no infection, but when rains come or fogs develop at night, and the fruits are kept moist over a period of several hours or sometimes days, the spores on the surface germinate and infection occurs.

CLOUDY SPOT

The cause of the blemish known as cloudy spot is not known. It is thought by some to be due to insect injury, similar to stigmonose. Typical cloudy spot areas were observed in a few lots of tomatoes and in others a somewhat similar type of injury was noted, but with the difference that larger irregular areas were involved and within the walls small greenish-white cavities developed. In no instance was there any indication of fungus infection.

GRAY WALL AND GREEN STRIPE

In some localities a noticeable proportion of the tomato fruits showed grayish discolorations of the outer walls of the fruit. In this gray wall there was sometimes a light and gray-green mottling and in some instances green stripes extending down the sides of the fruits. Such tomatoes often had thin walls and were excessively watery. When they ripened they were practically useless because of poor texture and uneven ripening. Gray-walled fruits will usually ripen after a prolonged period, but irregular green, yellowish, and red blotches were frequently prominent giving the fruit mosaic appearance. In the green state these tomatoes could not properly be designated as showing mosaic, but after ripening many of them would ordinarily be classed as having that disease.

GHOST SPOT

Ghost spot was found affecting a small percentage of the fruit in several localities. This injury is usually so slight that it is not necessary to cull out the blemished tomatoes. The white circular marks in the skin of green fruits are noticeable but no decay follows and as red color develops the circles are barely visible.

LATE BLIGHT (Phytophthora infestans)

Late blight was of minor importance. Although a careful check of the fields was made, no indications of this disease were found until we reached Orange County. Near Santa Ana one field was found with a high percentage of late blight, but infection occurred so late in the season that few tomatoes were lost.

MACROSPORIUM ROT (*Macrosporium sarcinaeforme*) ?

Species of *Macrosporium* no doubt inhabit tomato vines to some extent throughout the season; but as in the case of *Cladosporium*, most injury is caused by these organisms during the latter half of the season. Infection usually takes place through the stem scar, but may also occur through wounds or growth cracks. The decay induced is brown to dark brown in color with a slightly water-soaked margin. The internal decaying tissue is brown and may extend into the seed cavity. On the surface of the larger spots a grayish-brown mold is visible. This is especially true in affected stock on the receiving market.

MOSAIC

Mosaic was found to be one of the most common diseases of tomatoes in all districts. In fact, it seemed doubtful that there were any fields free from mosaic. The symptoms on fruits vary, but usually are characterized by irregular blotches and calico patterns of yellowish-green and green tissue which have a tendency to fade out during ripening so that fruits showing a rather distinct mottling when green may show relatively little discoloration when ripe. Consequently, tomatoes which on inspection at shipping point show an appreciable percentage of mosaic are often found to show less mosaic on the receiving market.

Near Brentwood a conspicuous type of mosaic known as "shoe string" was observed. The plants so affected are stunted in growth, are rather bushy, and the leaf blade tissue is so dwarfed and stunted that little but the mid-rib remains. Plants showing this type of mosaic bear few fruits and ordinarily none are large enough to be marketable. The tomatoes that are formed may show distortion and many have a tendency to form peg-like outgrowths from the stem end region. No fruit mottling was observed.

MOTTLED RIPENING

Mottled ripening in a great number of instances occurs in fruits that showed gray walls when they were green. Much of this irregular ripening appears to be due to poor quality fruit set at the last of the season, to disturbance in nutrition, to virus diseases, to other diseases, as aging. Many tomatoes showing mottled and irregular ripening during the early turning stages do eventually take on a fairly uniform red color, but ordinarily they ripen so slowly that they are unsalable by the time they are fully colored.

PLEOSPORA ROT (Pleospora lycopersici)

The fungus Pleospora seems to be represented only by its Macrosporium stage in the fields. Careful observations failed to reveal any lesions on fruits or on the vines that showed perithecia. It is apparent, therefore, that inspectors at shipping point will not be able to identify this disease as such. In view of the fact that it is impossible to separate the Macrosporium stage of Pleospora from other species of Macrosporium and Alternaria without culturing or microscopic examination, it seems advisable for the inspectors to designate this stem-end decay as Macrosporium rot.

SCARRING

Several different kinds of scarring were observed on tomatoes in the field, most of them apparently due to wind whipping and other mechanical injuries during the development of the young fruit. One particularly bad type was found on tomatoes grown in dry farming areas on the upland soils that are granular and hard enough to cause a decided injury to young tomato fruits in contact with the soil or whipped against it during high winds. Numerous dark brown to black scars of various sizes and shapes were observed on tomatoes still on the vine.

SHOULDER BRUISES

Shoulder bruises on tomatoes are generally caused by pressure against the field boxes, in the grading bins, or on grading belts during the packing process. In some instances the bruised areas do not become greatly discolored and are of little consequence. In others even slight bruises change color and make the fruit very undesirable by the time it is ripened.

SHOULDER CHECKING AND DISCOLORATION

Shoulder checks and discoloration occur most severely toward the latter part of the growing season in stock that has been subjected to rain or heavy fogs. The cause of these slight checks and pits is not known, but it has been found that under transit and ripening conditions tomatoes so affected become seriously discolored and frequently show decay by the time they are ripe enough for marketing. When numerous small checks occur over the shoulders a brownish discolored area usually results by the time the fruits are red.

SPOTTED WILT

Spotted wilt has become increasingly important in tomatoes along the coastal regions during the past few years. The plants show spotting

and yellowish discolorations of the leaves, and the tips of many young shoots are killed. Spotted wilt on the green fruit is relatively inconspicuous, although light green circles and blotches may be observed on careful inspection. When the tomatoes ripen the affected areas are usually yellowish to orange and in some instances take on a slightly brownish cast, thus making the affected fruits much more conspicuous after ripening than before. In a great many instances mosaic and spotted wilt viruses are associated in the same plant and the fruit mottling then becomes very conspicuous. The brown circles, loops, and streaks increase in intensity as the tomatoes ripen. This increase in discoloration has been shown to develop during the transit period. Most of the distinctly mottled fruit on the receiving market appears to be due to the combination of spotted wilt and mosaic.

STREAK

The type of streak caused by a combination of latent potato virus and tobacco mosaic was not common this year unless it was confused with spotted wilt symptoms. That these diseases have been confused in the past is evidenced by our colored photograph (Pl. 7, D, U.S. Dept. of Agr. Misc.Pub. 121) of streak. Most pathologists now agree that this illustration is typical for spotted wilt, but wheh this photograph was taken in 1918 spotted wilt was not known in the United States.

PUFFS

Puffy tomatoes were observed in many packing sheds. Ordinarily it is not difficult to grade out the undesirably puffy fruit, but in some tomatoes a peculiar puffy condition underneath the stem end was very serious. Such fruits usually show excessive shriveling, shoulder checking, and conspicuous discolorations by the time they become ripe. From the standpoint of shipping point inspection these tomatoes are a serious problem because in cutting for puffiness the grades require that the fruits be cut in the middle. Fruits of the type just described do not show puffiness when cut in that region, but do show undesirable puffiness when cut 1/2 inch underneath the stem scar.

A SUMMARY OF THE CEREAL RUST SITUATION IN VIRGINIA IN 1938

WITH NOTES ON OTHER CEREAL DISEASES

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Plant Disease Reporter
Supplement 115

October 1, 1939

Stem Rust

The pycnial and aecial stages of stem rust (Puccinia graminis Pers.) of grains and grasses were observed on the native American barberry (Berberis canadensis Mill.) in Virginia 11 and 14 days earlier in 1938 than had been previously reported. Pycnial infection was first observed on April 8, and aecia on April 15. Uredial infection was first observed on wheat on May 9, which is 11 days earlier than previously reported; on barley on May 11, which is 10 days earlier; on rye on June 4, which is about normal; and on oats on June 4, which is 4 days earlier than previously observed (Table 1).

Table 1.
Dates of appearance in Virginia of various stages of the cereal rusts on barberry, wheat, oats, rye, and barley for the years 1934-38, inclusive

	Barberry		Wheat		Oats		Rye		Barley	
Year	Pycnial	Aecial	Stem	Leaf	Stem	Crown	Stem	Leaf	Stem	Leaf
1934	Apr.24	May 10	May 29	May 23	July 5	May 25	June 11	May 23	Jun.2	May 23
1935	Apr.27	May 4	May 23	May 9	June 29	May 22	May 28	May 28	Jun.6	May 10
1936	Apr.22	Apr.29	May 20	May 20	July 11	May 23	May 30	May 19	May 21	May 16
1937	Apr.19	May 3	May 27	May 3	June 15	May 20	June 3	May 10	May 28	May 3
1938	Apr. 8	Apr.15	May 9	Apr.15	June 11	May 21	June 4	Apr.19	May 11	May 4

An interesting and direct correlation has been found to exist between temperature and moisture conditions in April, May, and June and the dates on which the various stages of stem and leaf rusts have been observed on the different host plants since 1934, the earliest date of our records.

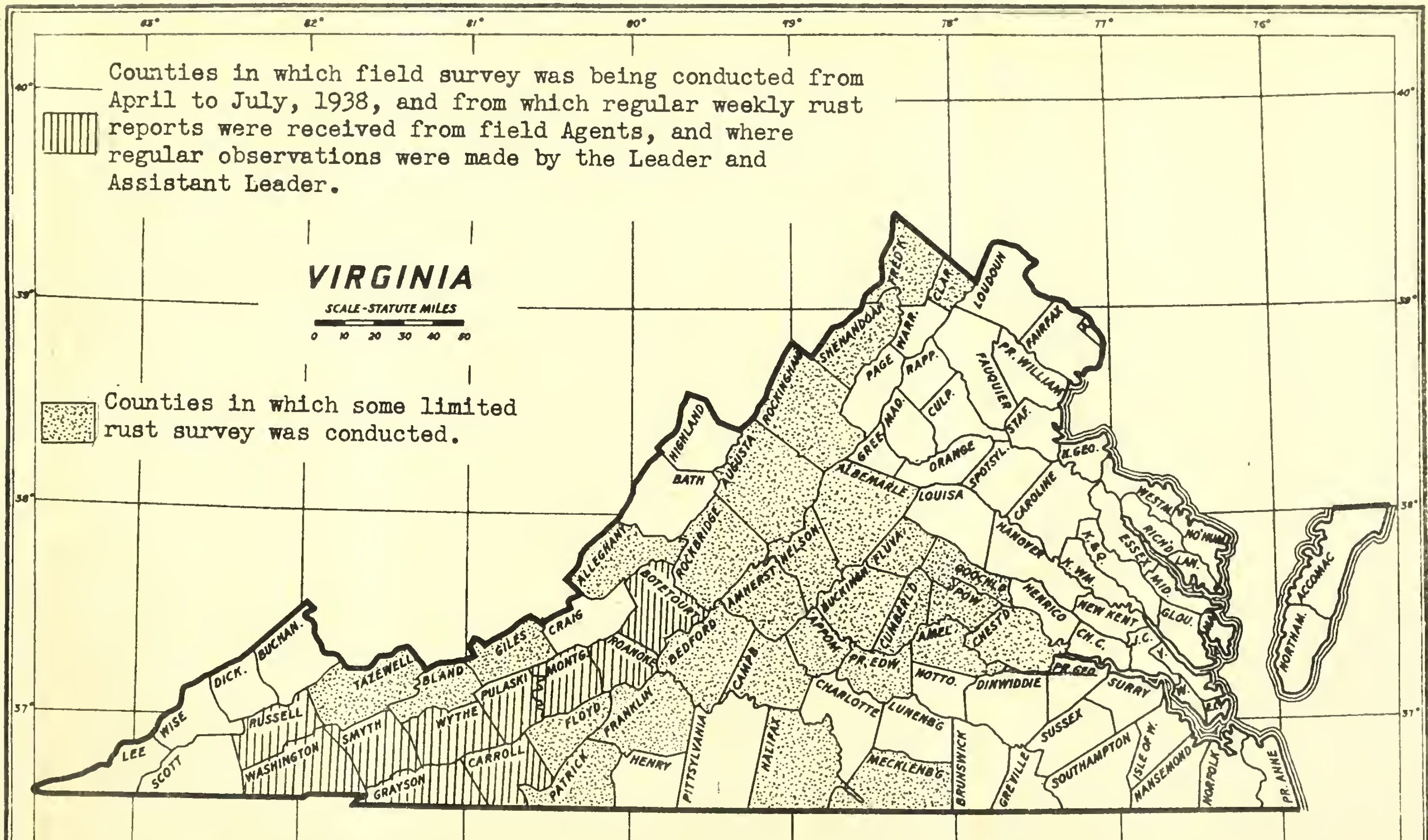
The early appearance of both stem rust and the leaf rusts in Virginia in 1938 appears to have been due largely to unusually favorable moisture and temperature conditions during the early part of the growing season. Table 2 summarizes weather information for the period March to July inclusive.

Table 2.

Precipitation and temperature data recorded by the U.S. Weather Bureau at Wytheville and by the Virginia Agricultural Experiment Station at Blacksburg, for March, April, May, June, and July, 1938.

	Precipitation		Temperature		
	Wytheville	Blacksburg	Wytheville		Blacksburg
	Ins.	Ins.	Mean	Normal	Mean
March	2.67	2.18	49°F.	42°F.	49°F.
April	2.77	2.33	53	52	53
May	6.45	5.04	61	62	61
June	2.65	4.54	66	69	67
July	8.02	8.42	73	72	72

In our rust report of May 21, 1938, which was the first report prepared by this office for the year, the following weather conditions were noted: "The season in April was about two weeks advanced, but during the first half of May both temperature and rainfall were considerably below normal. Hail was reported in several mountain sections. During the week ending May 21, there has been almost daily rainfall; days have been generally warmer and nights continued cool."



Readings and estimates in this paper are based on the following approximate number of field observations: Wheat 1100 fields; oats, 300; rye, 350; barley, 250.

MAP SHOWING NATURE AND EXTENT OF RUST SURVEY CONDUCTED IN VIRGINIA, 1938

November 1, 1914

U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF PUBLICATIONS

The following paragraph on the spread of rust from barberries is quoted from our rust report dated May 21, 1938: "On May 9 a few pustules of stem rust were observed on a few plants of wheat growing in contact with rusted native barberry bushes in Montgomery County. A trace of stem rust was observed on wheat and barley within a few yards of rusted barberry along the James River in Botetourt County on May 11, and on blue grass May 18. A field of wheat showing stem rust infection averaging 25 percent severity on 75 percent of the plants in the field was observed near Lebanon in Russell County on May 20. The heaviest infection was near heavily rusted native barberry bushes growing in the fence line along one side of the field. This stem rust probably appeared on the wheat at least 10 to 14 days earlier than it was observed."

For the week ending May 28, 1938, crop developments were recorded as follows: wheat--joint to hard dough; barley--flower to hard dough; fall oats--flower to milk; spring oats--joint to flower; rye--flower to hard dough. Rain fell nearly every day and the weather was continued cool with hail being reported in several southwestern counties. All native and common barberry bushes observed were moderately to heavily infected with the aecial stage of black stem rust. Numerous pycnia were still observed in some sections, while many aecia were observed to be drying up. All stem rust observed at this date had been on grain and grasses in the immediate vicinity of known locations of rusted native barberry bushes in unsurveyed territory. Stem rust had been observed on wheat in all counties covered, ranging from trace to 35/90. 1/ The heaviest infection observed was in one field of wheat on the farm of Mr. J. C. Bundy near Lebanon in Russell County, where heavily rusted native barberry bushes were growing along the fence around the field. Stem rust had been observed on barley in Halifax, Appomattox, Fluvanna, Botetourt, Roanoke, Montgomery, and Pulaski Counties, ranging from trace to 5/80; on rye in Botetourt, averaging T/50; and on blue grass in most counties covered. No stem rust had been observed on oats at this date (May 28).

1/ 35/90. In this and similar fractions used in this paper the numerator indicates the estimated percentage of rustiness of infected plants according to the "Scale for Estimating Rust" used by the Division of Cereal Crops and Diseases, Bureau of Plant Industry, and the denominator represents the estimated percentage of infected plants in the field.

Reports of observations on cereal diseases for the period May 24 to June 2 were made by Assistant State Leader R. S. Mullin for the following counties: Fluvanna, Amelia, Mecklenburg, Halifax, Appomattox, Campbell, Powhatan, and Goochland. Mr. Mullin was employed during this period as a field inspector by the Virginia Crop Improvement Association while on leave from our Bureau. On June 4 Mr. Mullin reported wheat to range from milk to hard-dough stages of development, and barley was in hard-dough stage or harvested. The weather was warm and rainy. Light to moderate stem rust infection was reported at this time. These counties are in the Piedmont section and are out of the present barberry eradication area. Very little is known of the barberry population in these counties.

During the week ending June 4 rain fell nearly every day. The days were quite warm and the nights were cool. Many instances of direct rust-spreads had been observed, the most severe infection being 75/100 on wheat in the immediate vicinity of rusted barberry bushes. Map records being made of all rust observations indicate very definitely that the earliest and most severe stem rust infections are in unsurveyed territory.

During the week ending June 11, the stage of development of wheat, rye and barley was recorded as being from milk to mature; fall oats, milk to dough; and spring oats from joint to flower. Most infection spots on barberry leaves had dried up, but some few new pycnial and aecial infections had been observed.

Near Fincastle in Botetourt County, wheat in a small bottom-field was infected with stem rust ranging from 10 to 75 percent. Several hundred native barberry bushes were growing along a draw in the field, many of them being in immediate contact with the grain plants. Nearly all severe stem rust infections can be traced directly to rusted barberry bushes in the immediate vicinity. In surveyed territory and in comparatively barberry-free sections, stem rust was very light on June 11.

On June 11, most fields of rye had been harvested with no appreciable damage by either stem rust or leaf rust, which appeared late and did not become heavy. Most barley had also been harvested at this time, but the yield and quality of late barley was undoubtedly reduced by both stem and leaf rust. It is estimated that the damage by both was 5 percent or more in many cases.

On June 13, Messrs. W. L. Popham and R. O. Bulger accompanied this reporter on an inspection trip down the Shenandoah Valley from Winchester to Blacksburg through the best wheat-growing sections of Virginia. No readings were recorded for rye in as much as all of this crop had been harvested. No stem rust was observed on oats. Stem rust

infection on wheat and barley observed in the counties covered on June 13 was recorded as shown in Table 3. Observations recorded by Agent R. L. Shaver on an inspectien trip on June 25-26 are also shown in Table 3.

Table 3
Stem rust infection on wheat and barley observed
June 13 and June 25-26.

Date	County	Kind of grain	Number of fields	Stage of development	Range of stem rust infection	Observer
June				1/		
13	Frederick	Wheat	4	SD-M	T-2/25-100	(Popham
13	Shenandoah	Wheat	3	MD	T-2/100	Bulger
		Barley	3	M	T/50-100	Matheny)
13	Rockingham	Wheat	4	SD-MD	T/25/100	"
13	Augusta	Wheat	4	MD-HD	T/50-100	"
13	Rockbridge	Wheat	2	SD	T-2/75-100	"
		Barley	1	M	Trace	"
		Orchard grass	1	H	None	"
		Blue grass	1	H	None	"
25	Campbell	Wheat	3	M	40-80/100	Shaver
25	Amhorst	Wheat	4	M	40-80/100	"
		Oats	1	MD	None	"
		Rye	1	M	10/100	"
25	Nelson	Wheat	4	M	80-100/100	"
		Oats	2	MD	None	"
25	Albemarle	Wheat	3	M	80-100/100	"
		Oats	2	MD	None	"
26	Augusta	Wheat	4	MD-M	50-80/100	"

1/ SD--soft dough; MD--medium dough; HD--hard dough; M -- mature; H -- heading.

By June 18, practically all barley and rye and most wheat had been harvested. Stem rust had been observed in all fields of wheat, averaging from trace to 10' percent in surveyed territory, and as heavy as 50-100/100 in small fields near rusted barberry bushes. Only a trace of stem rust had been observed on oats at this time.

During the week ending June 25, many interesting observations were made. We quote below paragraph 6, Stem Rust on Grain, from our rust report for this week: "In Wythe County, black stem rust in 12 fields of wheat in territory not surveyed ranged from 10-60/100 to 80-100/100, while in 6 fields of wheat in surveyed territory black stem rust infection averaged from T-10/25 to T-10/90. The range of stem rust infection in 2 fields of wheat in surveyed territory in Montgomery County was T-15/100

and 1-20/100 while in 6 fields of wheat in unsurveyed territory the range of infection was from 1-40/100 to 10-90/100. Similar readings have been obtained in other counties where any considerable amount of territory has been surveyed and barberry eradicated."

In our Rust Damage Forecast of June 25, we stated that rye and barley had been harvested with little or no appreciable damage by stem or leaf rust, except in a few cases. Many fields of wheat were harvested with very little rust damage, while stem rust damage to wheat in other localities will vary from Trace to 50 percent or more. By July 9, all small grains, except a few fields of late spring oats, had been harvested. It was observed that stem rust on spring oats was increasing rapidly, especially in unsurveyed territory. In Montgomery County stem rust in 3 fields of spring oats averaged 15/100. Farmers in northeastern Grayson County report almost complete losses of wheat crops due to stem rust in fields in the immediate vicinity of large numbers of severely rusted native barberry bushes.

On July 16 we submitted our last weekly summary rust report. The warm, rainy weather at that time was very favorable for the rapid development of stem rust on late oats. In some localities, near barberries, stem rust caused severe damage to oats. In surveyed territory infection was observed to be late, general, and comparatively light. Some fields of oats were observed in which stem rust losses were estimated to be as much as 25 percent.

Stem rust damage forecast.-- Most fields of early rye were harvested with little appreciable damage by stem rust, while in several fields of late rye stem rust infection was considerably heavier. It is estimated that the reduction in yield of rye due to stem rust was 1 percent.

Much early barley was harvested with little appreciable damage by stem rust, except in a few cases. However, it is estimated that infection was severe enough in many late fields and in unsurveyed territory so that the reduction in yield due to stem rust would be about 2 percent.

Many fields of winter oats, planted in properly prepared and fertilized seedbeds, will suffer very little from stem rust damage. However, in many fields of late spring oats in unsurveyed territory, it is estimated that losses were as much as 25 percent. It is estimated that the average reduction in yield of all oats due to stem rust damage was about 4 percent.

Early-maturing wheat in surveyed territory and in some of the Valley counties was harvested with little appreciable damage by stem rust. However, in unsurveyed territory in southwestern Virginia and in many

sections of the more important wheat-producing part of the State, stem rust was responsible for severe losses. After supplementing our rust observations in the field with available yield and weight data, it is estimated that the reduction in yield of wheat in 1938 due to stem rust was 5 percent.

Leaf Rusts

The same weather conditions which favored the early development of stem rust were also an important factor in the appearance of leaf rust (*Puccinia triticina*) on wheat on April 15, which is 18 days earlier than observed previously. Moderately heavy leaf rust (*P. dispersa*) infection was observed on rye on April 19. A trace of leaf rust (*P. agropyri*) was reported on bluegrass in Pulaski County on April 20. By May 7, leaf rust was general and of moderate severity in all counties on wheat, rye, and barley. By this date moderate infections had been reported on 10 different varieties of winter wheat in the Chilhowie rust nursery. A light infection of crown rust (*P. coronata* avenae) on oats was first reported in Roanoke and Botetourt Counties on May 21.

Leaf rust of barley (*P. anomala*) and of wheat, ranging from 5/75 to 65/100 had been observed in most fields by May 28. This rapid development of leaf rust was promoted by the heavy rainfall and favorable temperature which prevailed during May 1938.

By June 11, only light infections of leaf rust were observed on rye in early fields, whereas late rye showed leaf rust as heavy as 50-65/100. At this time 100 percent leaf rust infection was observed on barley, while on wheat it ranged from 10-100/100. A trace of crown rust was observed on fall oats, while all spring oats observed were still free from infection. By June 25 crown rust of oats had increased rapidly in severity, some fields showing an infection as heavy as 10-75/100. At the time of harvest 100 percent crown rust infection was observed in many fields of late-maturing spring oats.

Leaf rust damage forecast.--Estimates of reduction in yield for the small-grain crops attributable to leaf rusts are as follows:

Rye 1 percent; Barley 3 percent; Oats (crown) 3 percent; Wheat 5 percent.

Notes on Other Cereal Diseases

Incidental to the stem rust survey, in connection with the barberry eradication program, numerous observations on miscellaneous cereal diseases have been made.

The following paragraph is quoted from our Weekly Summary of the Cereal Rust Situation in Virginia for the week ending May 21, 1938:

"Powdery-mildew (Erysiphe graminis) was first observed on wheat on April 15, and has developed rapidly on wheat and barley since that date. Light to moderate loose-smut (Ustilago tritici) infection has been reported on wheat, rye, and barley in all counties observed. Barley stripe (Helminthosporium gramineum) was first observed in Montgomery County on May 2, and is now found generally. One field was observed in which about 20 percent of the plants were infected with stripe. Nematode (Tylenchus tritici) injury has been reported in several counties. It was first observed during the last week in April. One field in Montgomery County shows about 20 percent infestation. Barley-stripe and wheat nematode will cause appreciable damage in many fields. Stem-smut on rye (Urocystis occulta) has been observed in Grayson, Carroll, and Montgomery Counties."

In our weekly rust report for the week ending June 25, the following observations were recorded:

"Heavy rainfall during the past 3 weeks has been favorable for the increase of scab (Gibberella saubinetii), black chaff (Bacterium translucens undulosum), glume blotch (Septoria nodorum), and the various smuts. In many fields infection by these diseases has become quite severe. Fields of wheat have been observed in which wheat nematode has infected as many as 50 percent of the plants.

"The following diseases were observed in one small field of wheat near Speedwell in Wythe County on June 21 by Dr. H. B. Humphrey and this reporter: stem rust, leaf rust, loose smut, bunt, black chaff, Septoria glume blotch, scab, nematode, and powdery mildew. Any wheat that might possibly be harvested from this field will be unfit for milling purposes."

THE WHEAT STEM AND LEAF RUST EPIDEMICS OF 1938 IN KANSAS [1/]

By L. E. Melchers, Head of Department of Botany, Kansas Agricultural Experiment Station, and C. O. Johnston, Associate Pathologist, Division of Cereal Crops and Diseases, Bureau of Plant Industry, U.S. Department of Agriculture. [2/]

Plant Disease Reporter
Supplement 116 October 15, 1939.

The 1938 Kansas wheat crop was officially estimated at 193,000,000 bushels as late as June 10, but was finally reported at 152,114,000 bushels. Many opinions have been expressed as to the causes of the rapid decline of the crop. The many complicating conditions involved during the crop season make it difficult to evaluate the significant factors responsible for the rapid deterioration of the crop.

The impression exists that losses from stem rust are uncommon and of little consequence in the winter wheat belt of the Great Plains area. The stem-rust epidemic of 1935 in Kansas was accepted as something unusual and not likely to occur again for years because the only other major general epidemic up to that time occurred in 1904. Yet, Kansas and the hard winter wheat belt were visited again by stem rust in 1937 and 1938. Strangely enough, all three of these rust years occurred while Kansas was still struggling with the drouth. It has been suggested by some investigators that the cause of the 1935 epidemic was the culmination of a set of unusual conditions, all perfectly timed, and that such a combination rarely occurs. [3/]

1/ Contribution No. 394 from the Department of Botany, Kansas Agricultural Experiment Station, in cooperation with the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture

2/ The authors gratefully acknowledge the help of John O. Miller, Extension Specialist in Plant Pathology, Kansas State College, who gave aid in connection with field surveys.

3/ E. C. Stakman. The black stem rust epidemic in 1935. Pub. by Miller's National Federation, Aug. 16, 1935.

It now seems evident that environmental and other conditions are favorable rather frequently and that stem-rust losses are a matter that must be reckoned with in Kansas. It is, however, plainly evident, that the 1938 Kansas wheat crop was threatened with one of the worst epidemics of stem rust in the history of the State.

Crop Conditions Leading up to the Stem-rust Epidemic of 1938

The winter wheat crop of Kansas developed under environmental conditions during the fall and early spring which indicated that one of two things would probably happen. If ample moisture did not come during the heading stage, the lack of subsoil moisture would cause the crop to "burn up," and if moisture came in sufficient amounts, or more than adequate amounts, the possibility of rust loss would be great. Drouth conditions continued to prevail in most of the wheat areas of Kansas up to February, and the best informed individuals were not optimistic over crop prospects. As it turned out, Kansas probably obtained the largest yield possible under the conditions of above normal rainfall that occurred. Throughout the winter and early spring the crop looked "good from the top," but the absence of subsoil moisture was decidedly limiting the crop prospects.

In much of Kansas where wheat was sown in the fall of 1937 there was moisture for germination, a good stand was obtained and the fields generally went into winter in a satisfactory condition. The winter was mild and the crop survival was excellent. The extremely mild weather of February and March stimulated early top growth and the crop was several weeks advanced when the freezes of April 2 and 8 occurred in the Great Plains area. Speculation was rife on the damage from low temperature, and great alarm was spread as to its importance. While the freeze unquestionably did damage and all its injury may not have been accounted for, it is believed that the importance of freezing injury was greatly overestimated.

The cold snap was followed by excessive rainfall during May and June. Cool nights and heavy, early infection of leaf rust delayed the crop. Heading was slow and uneven, and, in some fields, never completed. In south-central Kansas, the straw was especially rank, weak, and soft. In most fields lodging was severe because of buckling and subsequent breaking of the straw at the uppermost nodes. The wheat plants in that area died prematurely, producing immature straw and shriveled grain. Many fields in this condition were examined and in most cases they presented an ashy, scalded appearance instead of the normal golden yellow. This unnatural color or ripening was plainly noticeable from the road. A few days later all

plants in these fields were dead. An examination of the roots and crowns of wheat plants and the water-soaked condition of the soil indicated that much of the injury was somehow related to environmental conditions affecting the plants.

Although no attempt will be made here to list all the important factors concerned with the decline of the 1938 wheat crop, it is certain that those listed in chronological order below were important ones:

1. A lack of fall and winter soil moisture in western half of Kansas, which led to inadequate and shallow root development.

2. Unusually mild weather in early spring initiated excessive top growth, so that the crop was several weeks in advance of its normal development at the time of the freezes of April 2 and 8.

3. Very early and abundant leaf-rust infection appeared in April and increased with devastating force throughout the growing season.

4. Heavy rainfall in May and June produced a water-logged soil over wide areas in Kansas. Combined with an advanced stage of sappy growth, the unfavorable soil conditions stimulated crown and root rots and weak straw, which later became brittle. In certain counties large losses occurred from floods and hail.

5. Stem-rust infection appeared in southern Kansas a month earlier than normally. While stem rust did considerable damage in some counties, it caused less loss than in 1935. Central and eastern Kansas would have experienced larger losses had it not been for the premature dying of vast areas of Early Blackhull and Blackhull, the cool night temperatures, and the large areas of Kawvale and other semiresistant varieties in eastern Kansas. Stem rust in 1938 never had an opportunity to exert its full influence.

6. The presence of other diseases such as black chaff, glume blotch, and foot-rots unquestionably were contributing factors. Towards the end of the season it was observed that

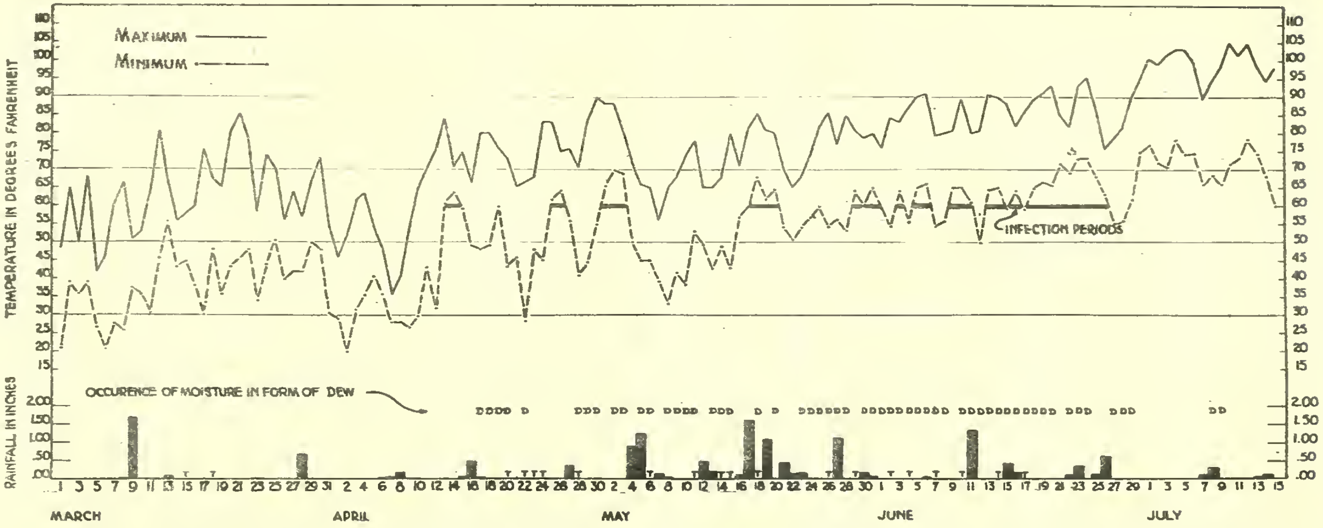


FIGURE 1A: MAXIMUM AND MINIMUM AIR TEMPERATURES, RAINFALL AND DEW OCCURENCE, AND PERIODS FAVORABLE TO THE DEVELOPMENT OF STEM RUST AT MANHATTAN, KANSAS, FROM MARCH 1 TO JULY 15, 1938.

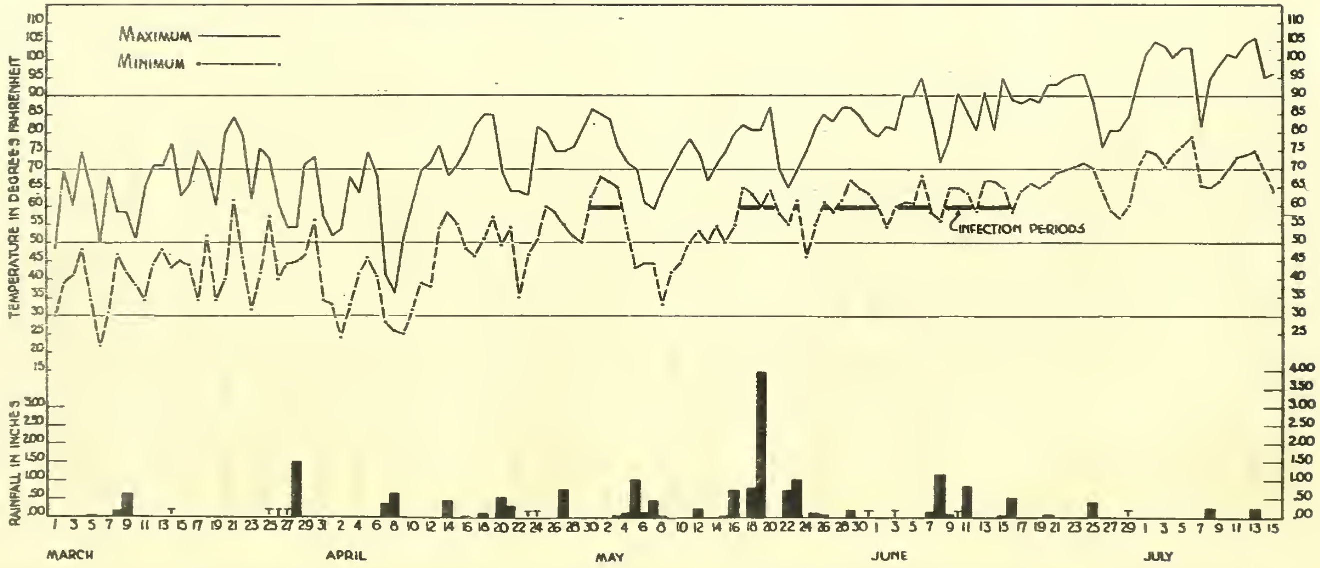


FIGURE 1B: MAXIMUM AND MINIMUM AIR TEMPERATURE, RAINFALL, AND PERIODS FAVORABLE TO THE DEVELOPMENT OF STEM RUST AT WELLINGTON,

Septoria nodorum Berk. was present on the shrunken, discolored, and broken nodes of the wheat, a common and widespread sign and symptom of the maturing crop. 4/ The importance of this organism in the decline of the crop is a matter worthy of further study, since this fungus has been reported in literature as a serious parasite. It is believed, however, that the excessive moisture in May and June markedly favored the incidence and importance of the above-mentioned diseases.

With this information in mind, it is evident that it would be impossible to evaluate the importance of each factor, or to estimate the loss that each disease may have caused. The chief purpose of this paper is to give a general picture of the wheat rust situation and to point out those facts about the wheat crop in as far as they were observed by the writers.

The Northward Spread of Stem Rust

As in 1935 and 1937, the northward movement of stem rust was again evident in 1938. Records show the inception of stem rust in southern Texas and its steady advance northward through Oklahoma, Kansas, and Nebraska. It was first reported from southern Texas (San Antonio) on March 27, from central Texas (Waco and Temple) on April 13, and from northern Texas (Denton) on April 23. About this time it also was reported present in plots examined at College Station, and on May 1, at Chillicothe, Texas. Beginning on May 4, a strong wind blew continuously from the south for several days at an average velocity of 20 miles per hour. 5/ This was followed by another period of strong winds for 3 days and nights about May 9. Stem rust was reported at the end of April in southern Oklahoma. 6/ On May 7, Chester reported

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4/ Creager, D. B. Septoria nodorum on nodes of wheat in Kansas. Plant Dis.Rep. 22: 241-242. 1938.

5/ Plant Disease Reporter 22: 157. 1938.

6/ Plant Disease Reporter Supplement 112, page 6. 1939.

Table 1: Average rainfall and number of rainy days in sections of Kansas for April, May, June, and July, 1935, 1937, 1938.

Month	Section of State	Rainfall in inches: Average 1935	Average 1937	Average 1938	Departure 1935	Departure 1937	Departure 1938	Number of rainy days 1935	1937	1938
April	Eastern	2.13	2.04	2.32	-1.14	-1.18	-0.98	8	7	7
	Central	1.02	0.57	2.56	-1.45	-1.90	+0.15	5	3	8
	Western	0.25	0.39	2.36	-1.78	-1.59	+0.38	2	3	8
	State	1.13	1.00	2.41	-1.46	-1.53	-0.12	5	4	8
May	Eastern	10.22	4.06	9.75	+5.37	-0.77	+4.82	17	11	15
	Central	8.46	3.96	8.26	+4.64	+0.12	+4.33	15	11	15
	Western	4.65	1.44	4.66	+2.00	-1.24	+1.94	13	8	10
	State	7.78	3.55	7.56	+4.01	-0.63	+3.70	15	10	12
June	Eastern	7.30	3.59	5.43	+2.40	-1.22	+0.61	15	7	10
	Central	5.05	3.18	4.39	+0.91	-0.88	+0.32	12	8	8
	Western	2.90	3.03	2.41	-0.05	+0.11	-0.50	8	8	8
	State	5.08	3.27	4.08	+1.08	-0.71	+0.10	12	8	9
July	Eastern	0.47	3.97	3.58	-3.30	+0.26	-0.13	2	9	6
	Central	0.76	3.76	2.71	-2.34	+0.69	-0.35	2	8	7
	Western	0.80	1.70	2.42	-2.05	-1.09	-0.36	3	6	8
	State	0.68	3.14	2.90	-2.56	-0.06	-0.29	2	8	7

Table 2: Mean temperatures for Kansas during April, May, June, and July, 1935, 1937, 1938

Month	Section of State	Mean temperature in degrees Fahrenheit: Average 1935	Average 1937	Average 1938	Departure 1935	Departure 1937	Departure 1938
April	Eastern	52.8	54.8	56.6	-3.0	-0.9	+0.9
	Central	52.6	55.0	55.2	-2.7	-0.3	-0.1
	Western	51.4	53.2	55.0	-1.4	+0.4	+0.1
May	Eastern	60.4	66.8	64.6	-4.1	+2.1	-0.1
	Central	60.0	67.3	63.5	-4.1	+3.0	-0.8
	Western	56.7	65.9	63.5	-5.4	+3.7	-0.3
June	Eastern	70.6	75.2	73.7	-3.6	+0.9	-0.5
	Central	71.1	75.1	74.2	-3.2	+0.7	-0.2
	Western	71.2	72.5	73.8	-1.2	0.0	0.0
July	Eastern	84.4	80.7	80.7	+5.6	+1.7	+1.6
	Central	84.8	82.6	81.8	+5.1	+2.7	+1.8
	Western	83.6	81.7	80.9	+5.6	+3.6	+1.8

stem rust around El Reno, Chickasha, Anadarko and Lawton, but, according to W. M. Osborn, rust had been seen at Lawton 10 days prior to this date.

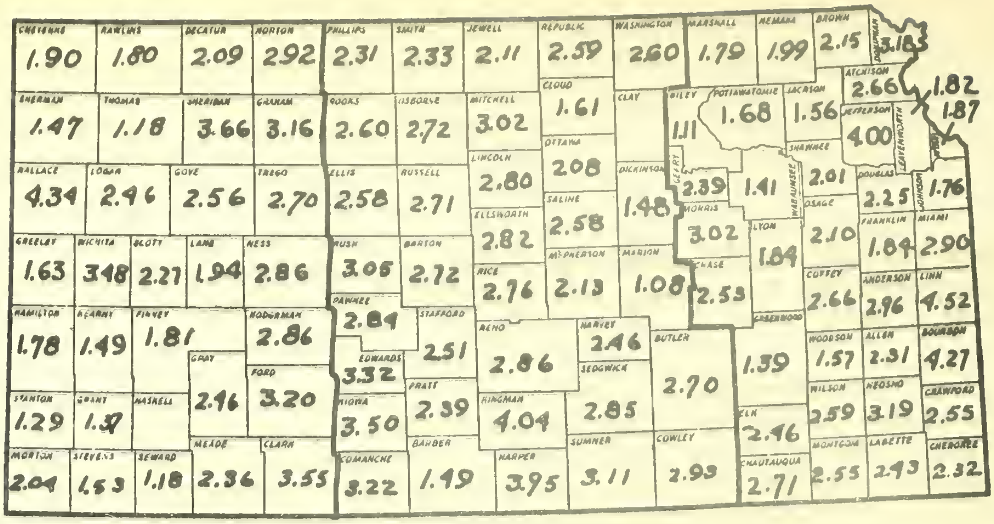
It is believed that stem rust was present in counties along the southern border of Kansas about the first of May, but no extensive examinations were made. It was first observed at Manhattan May 11. A week or 10 days later traces were reported in numerous counties in Kansas. During this period, heavy dews occurred and moisture conditions were favorable, but night temperatures were too low for infection. Figures 1a and 1b show that brief periods favorable for infection occurred at Manhattan on April 13-15 and 25-27, while in southern Kansas (Wellington) these periods seem lacking. From April 30 to May 3 and from May 16 to 21 brief periods favorable for infection occurred at Manhattan and Wellington, Kans. From the middle of May to June 1, stem rust became widely distributed in small amounts in central and eastern Kansas. At this time the crop was not more than a few days if at all earlier than normal.

The wheat crop had not suffered seriously from lack of moisture up to the time of the April freeze, despite the fact that subsoil moisture was lacking. This is in contrast with the situation prevalent in 1935 and 1937 during a comparable stage of crop development. The wheat in western Kansas was in much better condition than in 1935 and 1937.

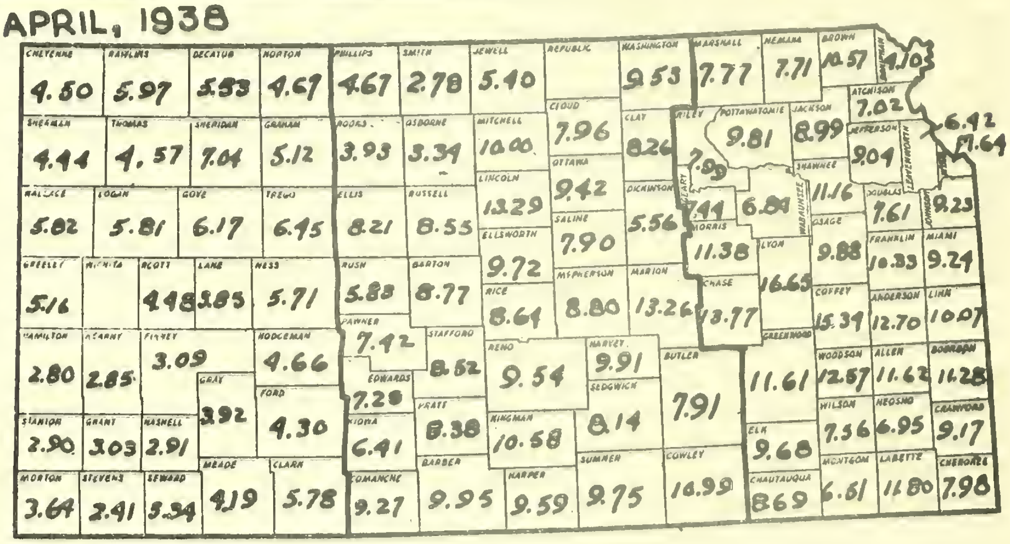
Meteorologic Conditions in Kansas in 1938 as Affecting Stem Rust

Weather conditions during May and June in general were somewhat similar to those of 1935 and 1937, yet certain features were distinctly different. Table 1 shows the rainfall for eastern, central, and western Kansas for April, May, June and July and the number of rainy days for the three stem-rust years.

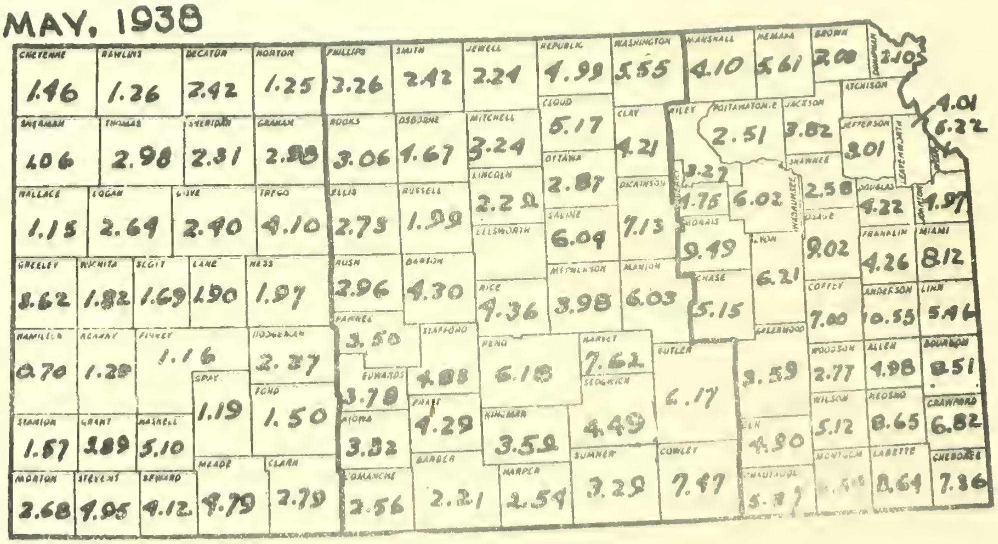
Factors that generally limit infection, development, and spread of stem rust in Kansas are rainfall and recurrent dews. Abundant evidence is on record for other years to show that infection has occurred in southern Kansas prior to its appearance in central or northern counties. Stem rust generally does not spread to the crop of central or nothern Kansas because of lack of rainfall in May and early June. This situation is usually



APRIL, 1938



MAY, 1938



JUNE, 1938

FIGURE 2 : TOTAL PRECIPITATION RECORD FOR KANSAS, APRIL, MAY, AND JUNE, 1938

accompanied by warm, dry winds and a rapidly maturing wheat crop, which make conditions unfavorable for further stem-rust spread. The rainfall totals for April, May, and June, 1935 and 1938, for eastern, central and western Kansas, and the State as a whole were nearly the same, but much more than for 1937. Table 1 shows that the precipitation for 1938 was well distributed over the two-month (May-June) period. Figure 2 shows the precipitation by counties for the various sections of Kansas for April, May and June, 1938. Added to this were the frequent dews that occurred in 1938, which generally are not nearly so prevalent in Kansas. It was important to chart the rainfall for nothern as well as for southern Kansas. Figures 1a and 1b show how similar the precipitation amounts and periods were, indicating that moisture fell over wide areas of central Kansas and on the same dates. The principal difference was that the amounts that fell on specific dates were considerably greater in the southern part of the State. There were slightly fewer rainy days during 1938 than in 1935, except in April and July when more were reported (table 1).

Figure 3 shows the maximum and minimum daily temperatures from May 15 to June 24 for 1935, 1937, and 1938. Similarities will be noticed in the trend of temperatures during each of the three years, yet there are some points of difference. The period from the middle of May to about the middle of June is regarded as very important in the development of the Kansas wheat crop and stem rust.

Table 2 shows the mean temperatures for eastern, central, and western Kansas and the departures for 1935, 1937, and 1938. If these were used as a criterion, it would seem that 1938 mean temperatures for May and June were nearer the normal than those for the same months in 1935. While mean temperatures doubtless are important, studies have shown that the minimum and maximum temperatures are more important. As mentioned in a former report, not until minimum temperatures become high enough to favor abundant germination of urediospores are heavy stem-rust infections noted in Kansas. 7/ The minimum temperatures for germination seem to lie

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7/ Plant Disease Reporter Supplement 107, Aug. 1, 1938.

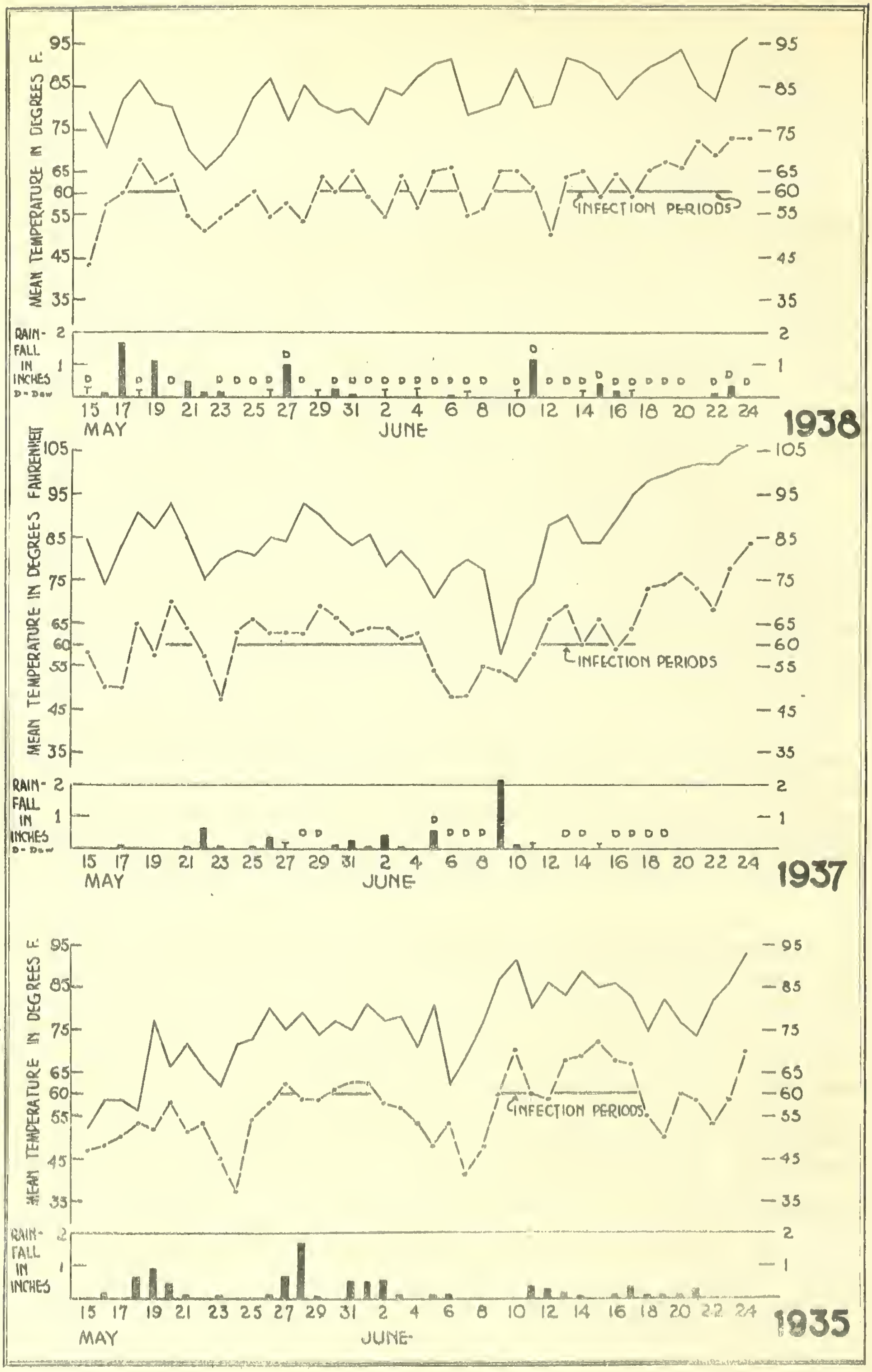


FIGURE 3: MAXIMUM AND MINIMUM AIR TEMPERATURES, RAINFALL AND PERIODS FAVORABLE FOR THE DEVELOPMENT OF STEM RUST AT MANHATTAN, KANSAS, FROM MAY 15 TO JULY 24, 1935, 1937, AND 1938

between 55-60° F. If we accept 60° F. as the minimum favorable temperature at which abundant germination and infection occur, then the minimum temperature curve for 1938 shows that several infection periods took place in northeastern (Manhattan) Kansas, and southern (Wellington) Kansas, as indicated in figures 1a and 1b.

The meteorologic conditions which were most favorable for infection and spread appeared to be confined largely to a period from May 15 to June 20. This same condition prevailed in 1935 and 1937. In each of these years short breaks occurred when for a few days conditions were less favorable for the spread of stem rust, but figures 1 and 3 indicate that May 15 to June 20 was the critical period.

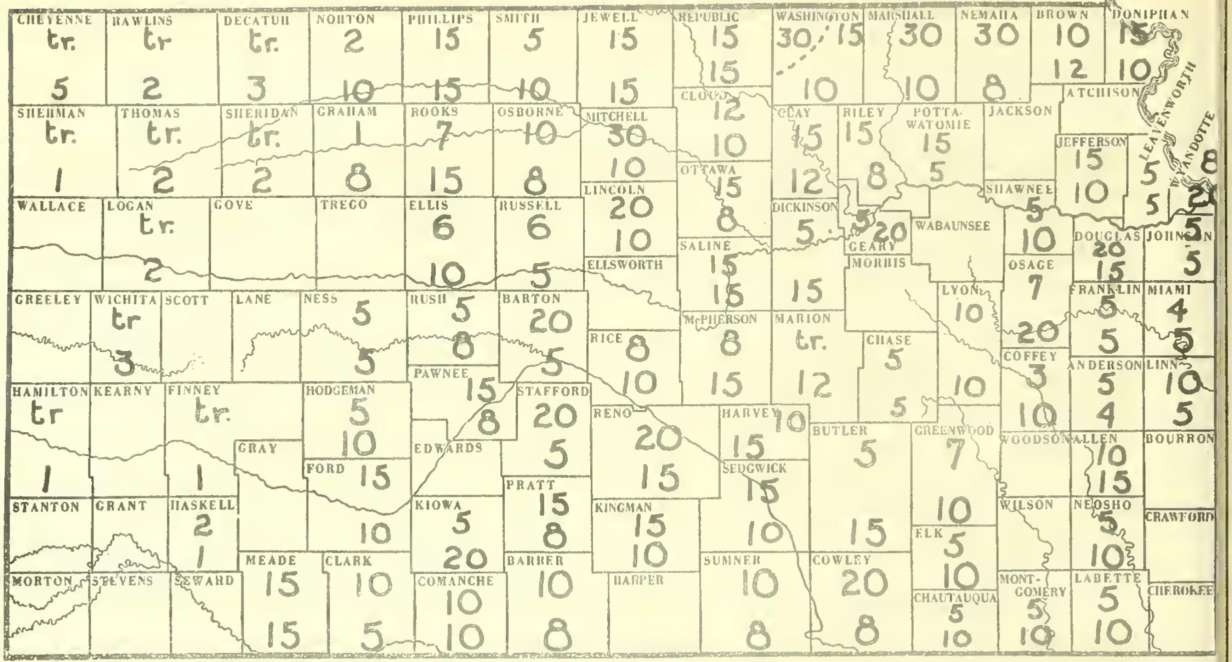
After the middle of June the crop matures rapidly and environmental conditions are less favorable for stem rust, so that little spread occurs.

Moisture was definitely not the limiting factor in 1938. A comparison of the favorable "infection periods" during 1935, 1937, and 1938 at Manhattan is presented in figure 3. This comparison is on the basis of 60° F. being the minimum temperature favorable for infection and spread of stem rust. If 55° F. were used as the lowest favorable temperature, figure 3 would present a still more contrasting picture. The temperature curves indicate that periods favorable for infection in 1938 were short and were separated by unfavorable periods, while in 1935 and 1937 there were prolonged favorable infection periods. It is believed by the writers that this largely accounts for the fact that stem rust was so unusually slow in establishment, increase, and dissemination in the 1938 Kansas crop.

This belief is supported by the following facts concerning the period from the middle of May to the first week in June: In 1935 there were 6 days and nights favorable for infection; in 1937 there were 15 such days and nights; while in 1938, there were only 5. It should also be noted (fig. 3), that in 1938 the favorable infection periods were short and discontinuous as compared with the more prolonged periods in 1935 and 1937.

Stem rust was observed at Manhattan on May 11, almost a month earlier than usual. Although found in fields in central and eastern Kansas and as far north as Riley county on June 4, it was present only in small amounts. Stem-rust infection in 1937 made its appearance first in the southern counties from Harper eastward and the trend of heaviest infection was in a northeasterly direction. It

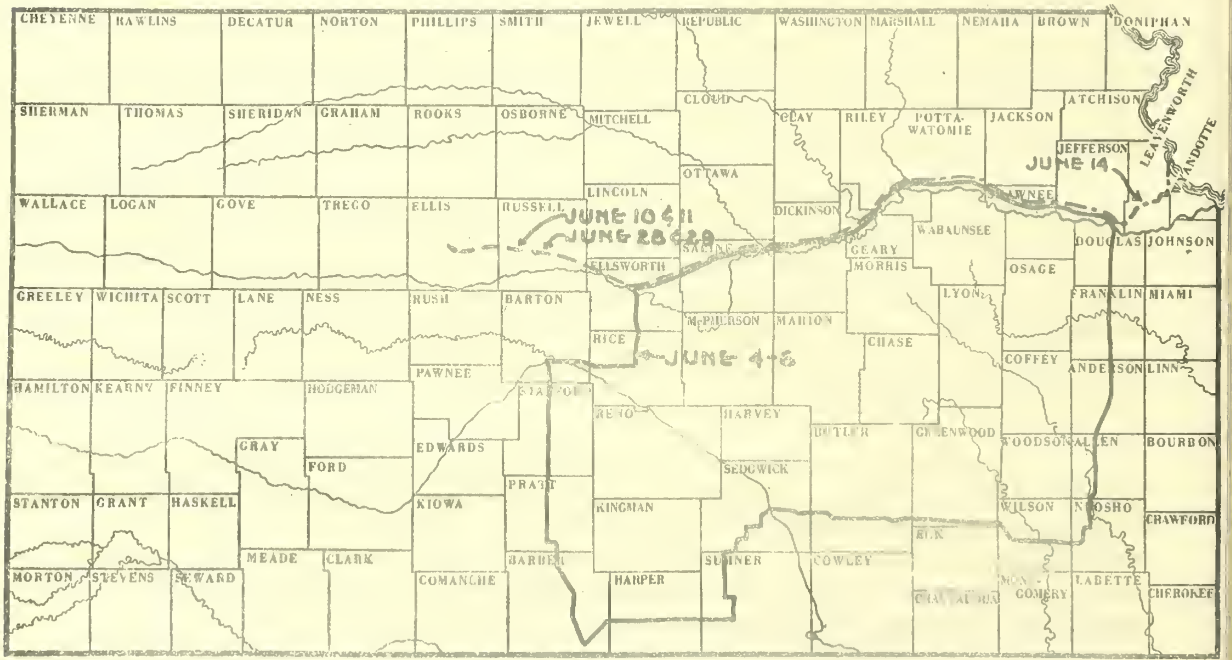
WHEAT STEM & LEAF RUST – 1938



KEY—
UPPER FIGURE IS PERCENTAGE LOSS FROM STEM RUST: AVERAGE 9.3%
LOWER FIGURE IS PERCENTAGE LOSS FROM LEAF RUST: AVERAGE 9.1%

ESTIMATES BY COUNTY AGENTS, FARMERS AND MILLERS

FIGURE 4:



AREAS INSPECTED FOR WHEAT STEM RUST IN 1938. DATES ON WHICH TRIPS WERE MADE ARE INDICATED.

FIGURE 5

was noted in 1938, however, that infection centered largely in the south central counties of Barber, Harper, and Sumner, whence it spread fan-wise, northward, with lighter infections in southeastern Kansas. Traces were present in central Kansas on June 4 on from 25 to 50 percent of the culms. The crop at that time was from 14 to 18 days from harvest. In the southern counties of central Kansas, some fields had from 5 to 10 percent rust on most of the culms, but the crop, 7 to 10 days from harvest, was rapidly deteriorating from other causes already mentioned. Damage from rust was, therefore, relatively unimportant except in occasional fields. Leaf rust had taken its toll and the water-logged soils and foot-rots were contributing their share of the injury. As one proceeded northward, it was evident that much more of the crop would "slump" in a manner similar to that occurring in Barber, Harper, Kingman, and Sedgwick counties. When questioned about the deterioration of the wheat crop, farmers almost invariably said: "too much rain;" "no good wheat crop ever was raised in Kansas in a wet year like this one." Some felt the freeze was largely responsible, but most people who gave weight to this theory at first had to revise their ideas later in the season. Because of unfamiliarity with the complicating factors and familiarity with the stem-rust damage in 1935 and 1937, county agents, millers, and others overestimated the injury attributable to stem rust. Figure 4 shows their estimated percentage loss from stem and leaf rusts. The writers believe the leaf-rust percentages are underestimated, while those for stem rust are too high in most counties. This is not unexpected because "red rust" (Puccinia triticina Erik.), in the minds of most people, is believed to cause little damage, while "black rust" (P. graminis tritici Pers.) always is the cause of injury, even if only a small amount is present.

By June 15 stem rust was present in most fields. Western Kansas escaped with the least injury from both stem and leaf rusts, although the infection and spread of stem rust were much farther west than usual in the counties bordering Oklahoma. For a time it appeared that northwestern and all of northern Kansas might have a severe loss because of later ripening of the crop. However, owing to hot weather, the rust failed to develop sufficiently to cause much damage.

Central Kansas had a moderate amount of damage, but just about the time that stem rust was appearing in large amounts the fading wheat crop checked any large loss that would have occurred.

In Ellis and Russell counties, and in counties north of these, many fields were severely attacked and considerable damage occurred.

The loss was heavy in the soft wheats of eastern Kansas, especially in the eastern tier of counties where varieties other than Kawvale were grown. The most impressive feature of the wheat crop after the middle of June was the rapidity of maturity brought about by numerous factors. Crop deterioration, followed by the rapid rise of temperature the last of June, brought stem-rust damage to a standstill and prevented the disease from reaching its maximum intensity.

Figure 3 shows that rain, trace of rain, or dew occurred each day, except two, during the period May 15 to June 24, 1938, at Manhattan. This is much more striking than in either 1935 or 1937, again demonstrating that moisture conditions were not the limiting factor in 1938.

A comparison of figures 1a and 1b reveals that the periods favorable for infection in southern Kansas did not occur so early or persist so long as they did at Manhattan. This may also help to explain why stem rust did not get under way earlier and why it failed to reach extreme severity in 1938.

Although the mean temperatures for eastern, central and western Kansas in May and June, 1935, were slightly lower than those for 1938, indicating more favorable conditions in 1938, the deciding factor unquestionably was the minimum temperatures for May and June.

Figure 5 shows the counties that were visited and the route followed in the stem-rust survey. Scores of fields were examined and observations were made on the prevalence and severity of rusts as well as crop conditions.

Losses from Stem Rust

Reduction in Yield.--As already stated, it is impossible to estimate the loss from stem rust in 1938, because of the numerous factors which entered into the picture. It is believed, however, that 3 percent is a conservative estimate. County agents estimated an average of 9.3 percent, but careful study by the authors indicates this to be too high (fig. 4).

The highest official estimate of the Kansas yield prior to harvest was 193 million bushels, but only 152 million bushels were harvested. Of that amount, only about 100 million bushels were actually millable. About 34 percent of the grain was fed on the farm or sold for feed at a heavy discount or disposed of otherwise. Part of this loss was due to stem rust. Due allowance is made for the excessive loss from leaf rust, other diseases, water-logged soils, hail and flood damage in arriving at the 3 percent loss from stem rust, which represents about 4 2/3 million bushels.

Abandonment. While no reliable figures are available, there was less abandonment from stem rust in 1938 than in 1937. Thousands of acres were a complete loss in 1938, but the damage was from a combination of the various factors, each one contributing its share.

Loss of Seed. As in the foregoing paragraph, no one factor was responsible for the need of new seed by the farmer on a large acreage, but much loss was sustained because satisfactory seed was not obtained, or farmers had to purchase new seed.

Varietal Resistance. The only observations on stem-rust reaction that were made in 1938 were those made in commercial fields and true comparisons were lacking. Generally speaking, Early Blackhull and Blackhull had low percentages of infection in all fields examined, but the area of the State where they were most commonly grown (south central Kansas), is the region where the crop deteriorated from other causes and stem-rust damage was secondary. It is known that these varieties do have a moderate resistance. Tenmarq, Turkey and Kanred were infected more heavily; especially was this true for Tenmarq and Turkey, while Kanred showed somewhat less infection. In a severe epidemic these varieties react similarly to stem rust.

The soft wheats of eastern Kansas were heavily attacked, especially in the northeastern area. Harvest Queen, Fulcaster, and Clarkan were badly rusted in some counties. Kawvale and Iobred had consistently less damage from stem rust than other varieties, and in the case of Kawvale, its striking freedom from heavy leaf-rust infection early in the season again made it stand out above all other varieties in Kansas in 1938. It should be stated also that in eastern Kansas where the soft or semihard varieties are grown, the wheat was practically free of the lodged, buckled, and broken straw condition so common in central Kansas.

Breaking of Straw

The reaction of certain of the standard varieties of hard winter wheat commonly grown in Kansas and Oklahoma to the conditions of the spring of 1938 is worthy of consideration and comment. It was apparent that a difference exists among the varieties of hard and soft winter wheats of Kansas with respect to the degree to which the straw broke and lodged.

Strange as it may seem, the so-called weak-strawed wheats, such as Kanred, did not show the symptoms of severe buckling of the straw and breaking at the nodes that were so commonly observed in Blackhull, Early Blackhull, and even Turkey in south central Kansas and in areas of Oklahoma. Certainly the factors responsible for straw weakness in Kanred, and those producing the weak-strawed condition of Early Blackhull in the spring of 1938 are entirely dissimilar. It may be safely said that stem rust was not the cause of the straw breaking in the many fields examined, although leaf rust and other diseases may have been contributing factors.

The greatest amounts of rainfall for April, May, and June, 1938, in the hard winter wheat area was in south central Kansas where the most severe damage occurred from "down wheat." The rainfall of this area was somewhat less than that of eastern Kansas for the same period (fig. 2), yet one did not find the soft wheat varieties breaking over. These observations are further borne out by a comparative study of varieties at Manhattan.

Leaf Rust of Wheat in Kansas in 1938

The foregoing discussion is the third report on the environmental and crop factors incident to the development of stem rust of wheat in Kansas. This series of reports has been made primarily to throw more light on stem rust in the great midcontinental winter wheat belt and on the factors favoring the development of epidemics. The present report deals primarily with stem rust of wheat, although leaf rust was economically much more important than stem rust in 1938.

Weather and crop conditions in Kansas have seldom been so favorable for the development of a leaf-rust epidemic as they were in 1938. The extremely mild winter throughout the central and southern plains area favored abundant overwintering of the fungus

in central and southern Texas and an unusually early and rapid increase in the amount of inoculum. The absence of low temperatures and the occurrence of plentiful rains in early spring favored early luxuriant top growth in winter wheat. This naturally provided an excellent medium for propagation for leaf rust. The vast expanse of wheat in such a succulent state, combined with frequent rains during May and early June, provided ideal conditions for the development of an epidemic.

As a consequence of the combination of so many favorable factors, leaf rust made an exceptionally early appearance in Kansas and rapidly developed to epidemic proportions. Before the end of the season the entire wheat-growing area of the State was subjected to the heaviest and most destructive epidemic ever recorded.

Leaf rust was first collected at Manhattan on April 13 about one month earlier than usual, although it was abundant in southern counties during the first week in April. By April 20 extremely heavy infections were reported from central Oklahoma, an area that from that time onward produced vast amounts of inoculum for northern distribution. By May 2 leaf rust was prevalent in nearly all fields in southern Kansas and on May 11, the date of the first collection of stem rust in the State, leaf rust was present in nearly all Kansas wheat fields. From that time on the disease quickly developed to epidemic proportions and by June 1, it overshadowed the danger from stem rust.

The meteorological conditions shown in figures 1,2, and 3 as factors favoring the development of stem rust also favored the development of leaf rust. It must be remembered, however, that leaf rust is able to develop over a wider range of temperature than stem rust, especially at temperatures below 60° F. It is clear that the periods favorable for infection during May were not short, as they were for stem rust, but were prolonged. On the basis of its lower temperature limitations, it seems likely that there were few days in May, 1938, during which conditions did not favor leaf rust infection and development.

Despite the severity and wide distribution of leaf rust, it is extremely difficult to make an accurate estimate on the loss caused by that disease in 1938, owing to the number and importance of other factors affecting yield. After many observations on the wheat crop in various parts of Kansas and a careful

consideration of the opinions of other informed observers, the writers have estimated an average loss of 12 percent for the State. This figure is at variance with the estimates shown in figure 4, as made by county agents, millers, and farmers. The average individual still believes that "red rust" has little direct bearing on the final wheat yield, so that the estimate of 9.1 percent loss (fig. 4) is rather an admitted concession on their part. The writers' estimate of 12 percent (20 2/3 million bushels) loss for Kansas is believed to be conservative; in fact, some observers have felt that even this figure is too low. The losses were very light and often negligible in the extreme western part of the State and were heaviest in the south-central counties, which normally produce the bulk of the Kansas wheat crop.

Not only was the 1938 leaf-rust epidemic extremely heavy, but it was also notable in that certain varieties of wheat, known to have a certain amount of field resistance, were heavily infected before the end of the season. Kawvale, which had shown promising resistance in 1935 and 1937, was rather heavily infected before harvest, although it exhibited considerable resistance earlier in the season. Iobred behaved in a similar manner, a fact probably attributable to the presence of many physiologic races of the fungus. Analyses of Kansas collections again indicated race 9 as the most abundant and widespread race, although races 15 and 37 also were important. Races 5, 13,19,28, and 65 also were found in occasional Kansas collections.

None of the commercial varieties of hard red winter wheat exhibited a marked degree of resistance. Tenmarq and Chiefkan were not so severely rusted in late season as Turkey, Kharkof, Kanred, Blackhull, and Early Blackhull. In the case of Tenmarq this lower amount of infection is known to be due to a certain degree of resistance. In Chiefkan, however, the small amount of leaf rust was due principally to a severe physiologic chlorotic mottling of the leaves that developed before leaf-rust infection became heavy.

It is impossible to estimate how much the heavy leaf-rust infection had to do with the deterioration of the Kansas wheat crop during the late part of the 1938 season. The writers observed that where deterioration was most rapid, severe leaf-rust infection was extremely heavy earlier in the season. It is believed that heavy leaf-rust infection, combined with too much moisture during May, was largely responsible for much of the lodging and premature death of the plants in mid-June, but so far no method has been devised to prove that point.

STEM RUST IN 1938

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Plant Disease Reporter
Supplement 117 December 15, 1939

Both stem rust and leaf rust were epidemic on wheat in 1938. Stem rust was unusually heavy in many of the principal grain-growing areas of the Southern and Central States, becoming particularly destructive in central Texas, in some fields of eastern Oklahoma, on soft wheat in northeastern Kansas, and in sections of eastern Nebraska. In much of northern Missouri soft wheat also was heavily rusted, although the loss was not so great as it was in 1937. The epidemic was severe in the spring wheat areas on susceptible varieties, reaching its greatest intensity in considerable areas of North Dakota. In other parts of the spring wheat States rust development was checked by the predominance of the resistant Thatcher wheat, as in Minnesota and in certain sections of northeastern North Dakota, or by hot dry weather, as in parts of North Dakota and South Dakota.

Losses to wheat as a result of stem rust were estimated at 10 percent for bread wheat in North Dakota and 5 percent in Montana and South Dakota. Spring wheat in Wisconsin was damaged to the extent of 5 percent, while the estimated loss for winter wheat was 10 percent. In Nebraska and Missouri the loss also was 5 percent, but elsewhere losses were smaller. Loss of oats equalled that of wheat in Oklahoma and possibly Kansas, but elsewhere, with the exception of Illinois where an estimated loss of 10 percent occurred, there was little infection on oats.

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A record of the epidemic of 1938 must begin with events in the fall of 1937. Stem rust was plentiful on *Hordeum jubatum* late in August 1937 in southern Minnesota, Iowa, and northernmost Missouri, and also was present on late oats. This inoculum may have been carried southward by northerly winds early in the fall, for rust was found on oats near Guthrie, Okla., on October 24 and a month later at Pryor, Okla., and Coffeyville, Kans. Wheat also was observed to be infected at Paoli, Okla., on October 24, and at four locations in Oklahoma in November and at one in Kansas. While summer survival of the rust and subsequent spread is possible, the northern source of inoculum appears to have been more likely in view of the extent of the area in which the rust occurred.

Overwintering

Although some of this infection may have survived the winter in Oklahoma or Texas, no evidence of survival was obtained in fields in which observations were made throughout the winter. Overwintering occurred in occasional fields in northern Mexico, however, and by April, despite the fact that there was less infection in general than usual, moderately heavy rust had developed near Sabinas Hidalgo, the area best situated for spread of inoculum to Texas.

Rust in Mexico

Southern Mexico apparently did not contribute to the epidemic in the United States in 1938, nor could it have furnished all the rust for northern Mexico.[1/] Observations and collections made in southern Mexico in February 1938 indicated that this region does not ordinarily take part in the interchange of rust from north to south and from south to north. In the first place, Marquis wheat, which is extremely susceptible to stem rust in the spring-wheat area of this country, has been grown in southern Mexico for a number of years because of its resistance in that region. In 1938, races 59 and 38 were the only ones identified from collections made in southern Mexico, except for one collection of race 24; and races 59 and 38 do not attack Marquis normally. Race 56 was not among those identified, although it was obtained in northern Mexico and in adjacent areas of the United States. Furthermore, nine different races were found in northern Mexico, all of which subsequently were found in the United States. This would indicate that, at least in 1938, the southern grain-growing areas of Mexico did not contribute inoculum to areas farther north.

Near the Texas border, however, observations in February and April indicated that there was enough stem rust on wheat to furnish the small amount of inoculum that apparently was scattered over central Texas.

1/ E.C.Stakman, W. L. Popham, and Robert C. Cassell. Observations on stem -rust epidemiology in Mexico (Abs.). Phytopath. 29: 22. 1939.

Rust was light on the whole in the grain-growing areas of northern Mexico, and no infection at all was found in the Laguna area around Torreon. Traces were observed in most fields near Saltillo and Villa Juarez in April; and several fields were heavily infected near Sabinas Hidalgo and others at Ramos Arizpe, Arteaga, and west of Saltillo. One of the fields at Sabinas Hidalgo, comprising about 100 acres, had an infection of about 50 percent in severity. This area was well situated for dissemination of inoculum by the wind into Texas. The accompanying map indicates these areas in relation to Texas. (fig. 1).

Possible overwintering in Oklahoma

The possibility that rust overwintered in scattered fields in Oklahoma during 1937-38 occurred to observers who examined fields in Oklahoma early in June. Heavy stem rust was found in a number of fields near Paoli and Eufaula on June 1 and 2. When average field infection south of Paoli was 1 to 5 percent in severity, in a field just north of Paoli there was up to 50 percent of black rust in several centers that measured several rods across. The same was true of a field near Norman in this same area, in which some plants had been killed by the rust. The same type of infection was observed in a field near Checotah, in one at Muskogee, and in another at Choteau, while rust in fields in intermediate areas varied from 1 to 10 percent in severity. The possibility of overwintering in these fields is supported by the fact that stem rust was present in these general areas late in the previous fall and that in those areas where no rust was found in November no such heavy centers were found in June. Furthermore, this spotting was not so general as was found in Missouri, where it presumably resulted from early spore showers. In the absence of definite evidence of winter survival, however, such as can be furnished only by following the rust from month to month throughout the winter, no final statement regarding overwintering in these fields of Oklahoma can be made.

Spring Development in the South and Northward Migration

Rust was first observed in Texas in the wheat plots at College Station on February 2. About third-generation infection was observed at Troy on March 6, and later observations indicated that a thin scattering of rust had appeared in San Antonio and other areas of southern and central Texas at the same time as that found at Troy. Weather maps indicate that conditions were favorable on January 16 for transportation of spores from the rust areas of northern Mexico into central Texas. Two stem rust spores were trapped by Mr. McFadden on January 15 at College Station. Additional inoculum probably was carried into Texas about March 4 or 5, to produce the second-generation rust found at San Antonio on March 27. Near San Antonio there was considerable early grain, and, as a result of excessive rainfall,

Figure 1.— Grain-growing areas of northern Mexico.

abundant rust developed in some of these fields fairly early in the season. No stem rust was found north of Waco by the middle of April, although the leaf rust epidemic that characterized the season was well under way throughout the State by April 1. Stem rust infection developed earlier, however, in the Waco-Temple section of central Texas than in the epidemic years of 1935 or 1937, and was abundant by the time the first infection was found at Denton, in the northern section (April 22). According to Mr. I. M. Atkins, stem rust was general in the Denton area by May 1, about two weeks earlier than in the normal year. Wheat also had headed from 10 days to 2 weeks early. However, May was cool, and this probably prevented heavy damage by rust in this section. Final development in the southern section was about 35 percent in severity; in the area north of Waco and Brownwood the average infection was 5 percent, with moderately heavy rust in some fields. Stem rust was not an important factor in the middle-western section and in the Panhandle.

Centers of heavy infection characterized the epidemic in much of the winter wheat region of the Southern States. On May 14, when the average field severity in Texas as far north as Waco was 10 percent, the rust was as heavy as 50 to 75 percent in scattered centers a rod or more across. This condition, which of course is not uncommon in this region, appeared to be the result of early, light spore showers, and was observed in many fields in the winter wheat area.

On May 11 and 12 rust was reported[2/] at Manhattan, Kansas, and at a number of places south of there. Inoculation of this area may have taken place during the period April 27-28, when a low-pressure area moved from the Texas Panhandle to central Wisconsin, the wind sweep on the east side of the low apparently carrying spores as far as western Illinois. Further inoculation occurred on May 3-5, when a low moved from southwestern Kansas across southern Kansas northeastward to western Wisconsin, as a result of which scattered third-generation infections were observed in Oklahoma, eastern Kansas, and Missouri on June 3 and 4. South winds on May 17 and 18 probably were responsible for the infection observed at Lincoln, Nebraska, on May 30, and for second-generation infections found in southwestern Missouri on June 3. New infection centers found in Missouri on June 4 appeared to be the result of wind-blown inoculum brought from the South on May 25. Field observations indicated that these periods of south wind were important in the winter wheat area, but on the basis of results of slide exposures it is to be concluded that spores were being transported by air at other periods during May also.

[2/] C. O. Johnston in the Cereal Courier 30: 60. May 25, 1938.

Stem rust appeared later in western Oklahoma and Kansas. It was first reported on wheat at Woodward, Okla., on May 19, and was observed in Gove County, Kans., on June 5.

On June 5, when the wind sweep again was northward, there was abundant inoculum in the southern wheat belt. Harvest was in progress in northern Texas, with from 5 to 20 percent of rust in north-central counties; nearly all wheat was ripe in Oklahoma, with an average of 10 percent rust in most fields; while in southwestern Missouri and southeastern Kansas the infection averaged about 1 percent in severity. Primary infection was present in northern Missouri and Kansas. Spores were trapped as far north as Fargo, N. Dak., on this date, and field infection was observed on June 15 in west-central Minnesota and at Brookings, S. Dak., and was present as far north as Fargo, N. Dak. Although rust was first observed in the plots at Fargo on June 11, it is probable that this was the result of a very light spore shower during an earlier period of south wind.

Final development of rust in Oklahoma was as follows: Rust severity averaged about 10 percent in the south-central section at harvest time, and in the northeast and north-central section; in the east-central counties the rust varied from 10 to 25 percent in severity. In a more normal year an average infection of about 1 percent is to be expected.

Aside from the severe epidemic of leaf rust that characterized the season of 1938, another factor of considerable interest was the area of root-rot injury that extended from north-central Oklahoma, in a strip about 100 miles wide, through Kansas into southern Nebraska. The injury was at first reported as frost injury by some observers and was attributed by others to various causes. Considerable break-over of stems occurred in central Kansas, being more severe in the Caldwell-Kingman area than elsewhere. In some fields of hard wheat 95 percent of the stems were broken over, causing more damage than rust. A sequence of conditions which need not be given here, including, however, superabundant May rainfall resulting in very dense succulent growth, caused heavy damage. It is important, however, to emphasize the fact that this damage definitely was not due to stem rust.

There was considerable variation in the amount of rust that developed in Kansas, the greatest severity being observed in sections of the northeast. In southeastern Kansas, where wheat was ripe by the middle of June, rust was relatively light, varying from 1 to 15 percent between Wichita and Fort Scott, while west of Wichita infection was heavier, averaging about 25 percent in severity at Harper and Kingman. In the northwestern section, west and north of Hays, rust was light. There was sufficiently heavy infection in the northeastern part of the State, however, to damage

soft wheat. On June 18 when some fields of soft wheat were still in the medium dough, rust severity was 20 to 50 percent in the area between Troy, Hiawatha, Holton, and Manhattan. Rust also caused considerable damage between Lebanon and Marysville, where wheats were later than in other sections. Damage was not directly correlated in the various areas with severity of infection, but varied with the time of maturity of the grain.

The difference in susceptibility of hard and soft wheat is shown by comparative readings made at two different stages of development in northeastern Kansas. On June 6, when rust severity was approximately 1 percent on soft varieties, hard wheat showed only a trace; later, on June 18, when wheat was in the dough stage or already ripe, the range of 20 to 50 percent on soft wheat exceeded still more the 1 to 15 percent on hard wheat.

In Missouri, soft wheat in the northern half of the State was most seriously affected by rust. Severity reached 40 to 50 percent in a considerable number of the fields. Elsewhere there was less rust, although final severity in the west-central section between Nevada and Harrisonville averaged about 35 percent. By ripening when it did instead of a few days later, much wheat in this area escaped serious loss, although late fields were damaged considerably. In the Missouri Valley section east of Kansas City, in Jackson and Lafayette Counties, and north of the river in southern Ray County there was 30 to 40 percent of rust in many fields that were in the soft dough on June 16. Many fields in the soft-wheat area near St. Joseph developed 60 to 75 percent of rust by the time they were ripe, with considerable shriveling. Damage was less severe in the east-central section, but was heavy in Ralls and Marion Counties of the northeast, and there was considerable damage in some north-central counties. The same difference between the amount of rust on hard and soft varieties was observed in Missouri as was the case in Kansas.

Heavy rust developed in Nebraska in certain fields of the eastern section, from Pierce County south into Polk County on the Platte River and west to Hall County. Heavy rust also developed in Saline County and in the extreme southeast. Premature ripening as well as leaf rust, however, contributed to the shriveling. (Observations were not made in all sections.)

Rust on Barberries

Before rust appeared in southern Oklahoma, barberry bushes in the Northern States were becoming infected. Both pycnial and aecial stages appeared on barberries considerably earlier than usual. Pycnia were ob-

served in Ohio on April 14; April 19, the date of observation in Illinois, is the earliest on record in that State; and in only one year has infection on barberries in Minnesota been observed earlier than in 1938. Aecia developed during the last week of April and the first week of May in the territory from Ohio and Michigan west to Missouri, Iowa, and Minnesota (fig.2); and in most of this area aecial infection developed on barberry bushes from 4 to 6 weeks before uredial infection appeared on grains away from known locations of bushes. Barberries also rusted in Kansas, Colorado, Nebraska, North Dakota, and Montana. Spread of rust from barberries was observed on May 24 and 25 on grasses in two counties in Missouri, and on wheat in Ohio on May 27, on grass in Wisconsin on June 1 and 2, on grass and rye in Iowa on June 1, on grass in Minnesota on June 6, and on rye in Wisconsin on June 6. Following this, spreads were widely distributed and unusually abundant, the same favorable weather conditions that promoted rust development in general operating toward the development of rust near the bushes.

It is becoming increasingly evident as time goes on, however, that the obvious spread of rust from infected bushes is not the only, or necessarily the most destructive, result of barberries. Production and perpetuation of new and virulent rust races on barberries have been discussed elsewhere, and new evidence is presented again in 1938 in the results of the physiologic race surveys. There is also the significant and interesting find of a large barberry bush in western Minnesota in 1938 which was located by following up the clue offered by identification of the unusual rust races 65 and 147 collected in that section, and by tracing the telial stage of rust on quack grass to the bush.

Slide Exposures

Slide exposures indicated that stem rust spores were in the air as far north as Nebraska during eight periods in May and also during eight periods, of from 1 to 3 days each, in June. Up to the middle of May spores were not caught north of Nebraska and southwestern Iowa. Although the periods of spore showers are not so sharply delimited as in some years, there are a number that are of particular interest in connection with field observations that already have been described. Wind was south from Oklahoma City to Falls City, Nebr., on May 3 and 4, and 960 spores per square foot of ground surface were trapped at Falls City on the 3d and 384 at North Platte, Nebr., during the 48 hours. During the period May 16-19 winds were north and northwest from Oklahoma City, and spores were trapped as follows:

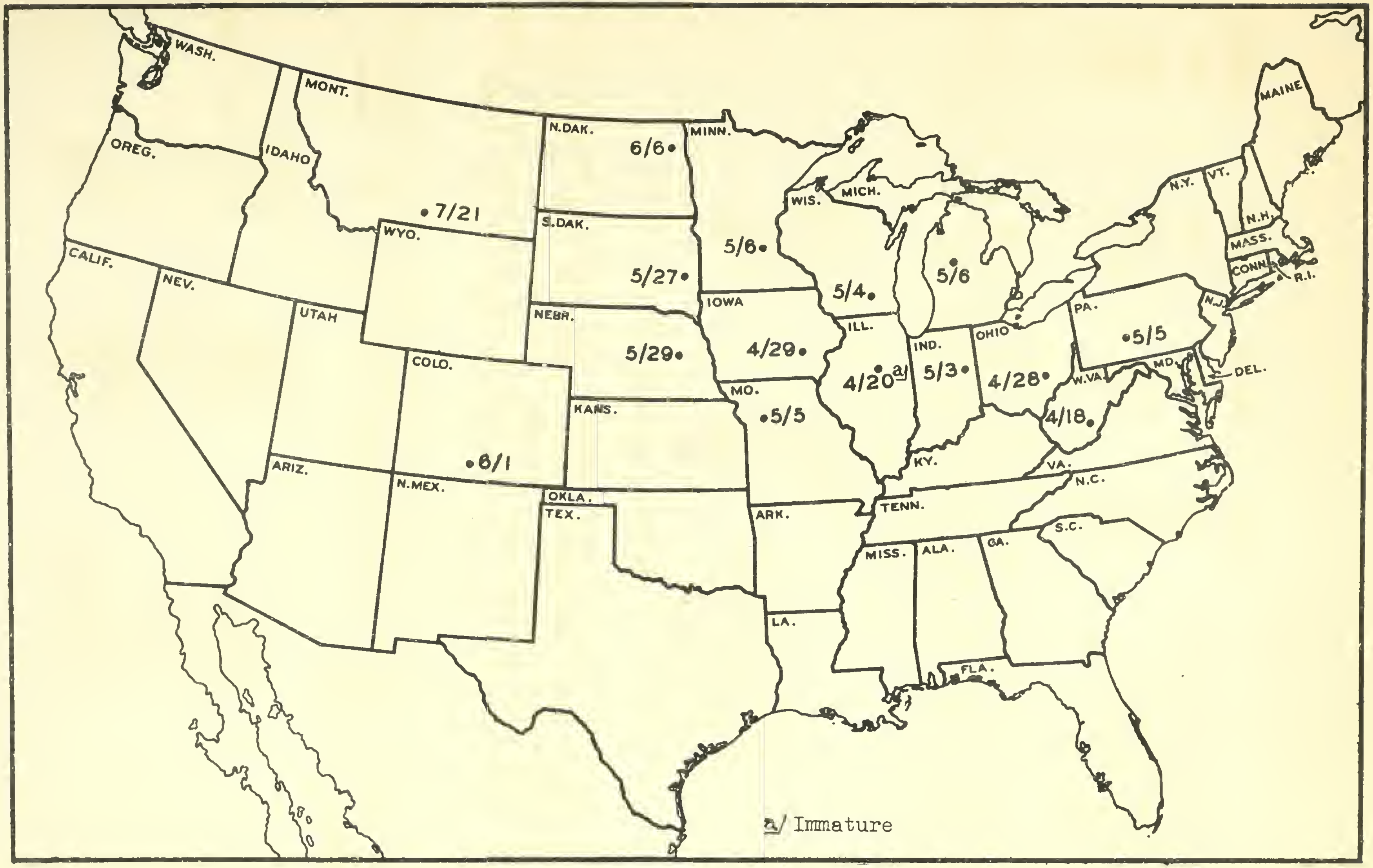

Figure 2.— Aecial infection on barberry bushes (earliest reported only).

	May 16	May 17	May 18	May 19
Oklahoma City, Okla.	1,296	1,152	432	288
Lincoln, Nebr.	48	0	0	0
Falls City, Nebr.	1,536	9,120	720	480
Beatrice, Nebr.	672	816	3,322	384
North Platte, Nebr.	1,440	576	0	576
Turin, Iowa	48	0	0	96

Stem rust spores apparently reached Lansing, Mich., on May 22 at the rate of 528 per square foot, although there had been one or two spores per slide observed earlier. On May 25, winds were north and northeast from Dodge City, Kans., to Minneapolis, Minn., and east to Green Bay, Wis. On these two days spores were caught as follows:

	May 24	May 25
Dallas, Tex.	95,616	33,600
Oklahoma City, Okla.	96	6,192
Falls City, Nebr.	6,000	1,680
Beatrice, Nebr.	1,440	528
Madison, Wis.	192*	0

*First to be caught at Madison

On June 4 and 5 there was a general northward wind sweep, already mentioned, and spores were trapped from Texas to North Dakota, the number varying from 18,240 at Dallas and 34,560 at Oklahoma City (on the 5th) to 960 at Brookings (during the 48 hours) and 192 at Fargo. At corresponding stations eastward, as in Missouri, Iowa, and Minnesota, spores also were caught on slides, but in smaller numbers.

The period of June 13 and 14 was outstanding so far as inoculation of a wide area was concerned. Wind was south and southeast from Dallas, Tex., to Moorhead, Minn., Bismarck, N.Dak., and Marquette, Wis. Spores were trapped as follows:

	June 13	June 14	
Texas	3,648	13,056	
Oklahoma	92,864	86,352	(see fig.3)
Kansas	154,800	181,200	
Missouri	738	1,536	
Nebraska	37,296	17,040	
Iowa	18,480	2,880	
Minnesota	26,688	5,568	
South Dakota	10,800	1,824	
North Dakota	1,248	96	

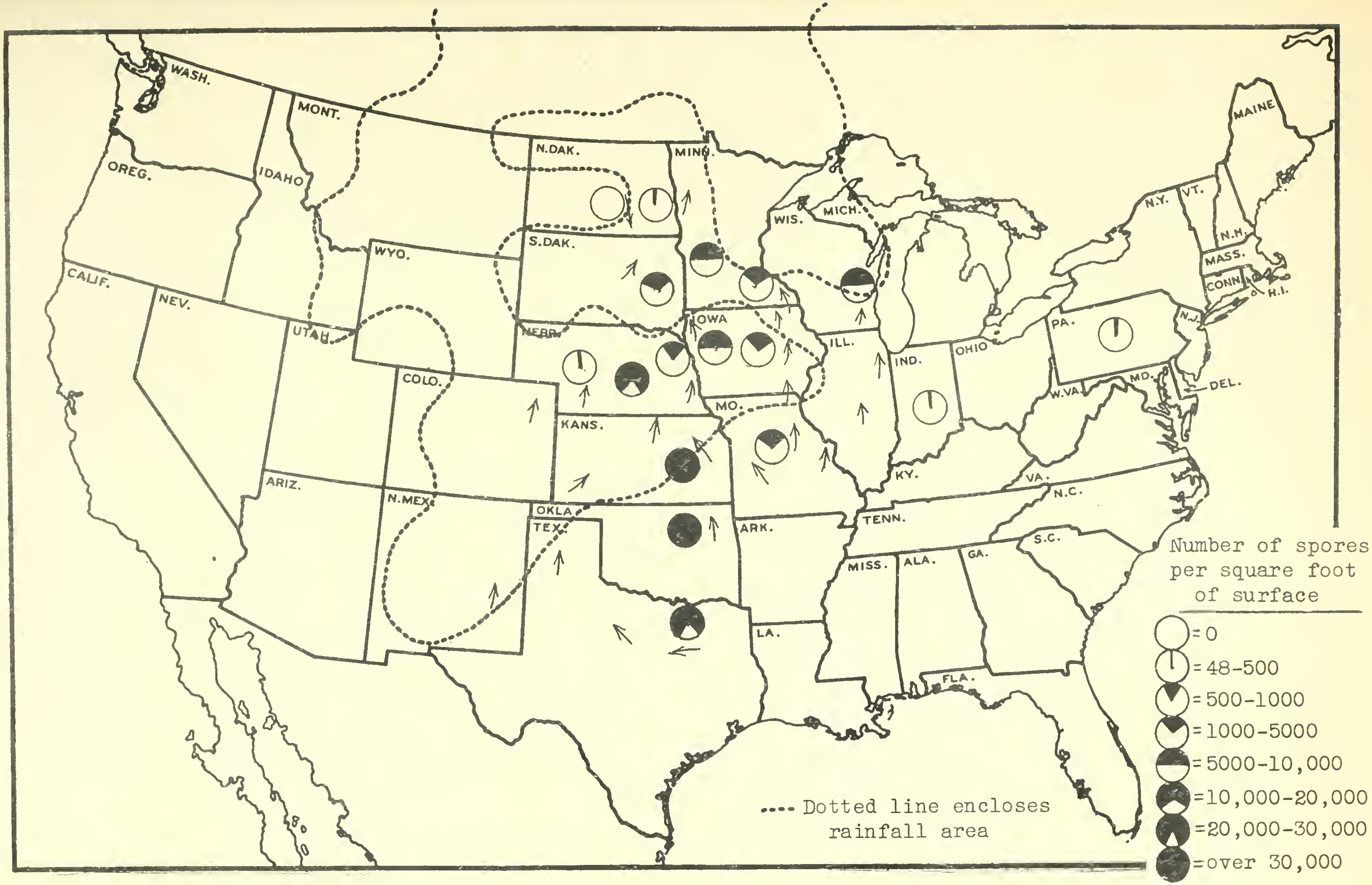

Figure 3.—Stem rust spores caught on vaselined slides exposed on June 14, 1938, wind direction, and rainfall.

Rain fell over most of this area at some time during June 13-15: on the 13th in eastern South Dakota; on the 14th in Kansas, Nebraska, northwestern Missouri, most of Iowa, in Minnesota from St. Paul and slightly west northward to Winnipeg and beyond, and in parts of North Dakota; on the 15th in sections of the spring wheat area not covered previously. Effects of this inoculation began to make their appearance on June 22 and 23 in fields of susceptible wheat and barley from Nebraska northward as far as southern Manitoba, Canada.

Intervening periods in which spores were present in the air at a number of stations, which will not be described in this report, included the following: May 10-11, May 22, May 26, May 30-31, June 1-2, June 6, and June 8-9.

In the spring-wheat area spores were trapped somewhat later in May than was the case in the preceding 3 years, and in general the spore load of the air was lighter than in 1937. Furthermore, the largest number of spores found on any one slide in June was less than one-third the largest number found in 1935; 263,808 per square foot were counted on the slide exposed at California, Mo., on June 13, 1938, as compared with 921,600 at Waverly, Nebr., on June 29, 1935. The first spores to reach the spring wheat stations, aside from a few caught in Minnesota in May and a few questionable spores caught in South Dakota, were found on Minnesota slides on June 2, in South Dakota on June 1, and in North Dakota on June 5. The first stem rust in quantity to come in was observed on June 5 in South Dakota, with 960 per square foot trapped during a 48-hour exposure; on June 8 in Minnesota, with 2,496 trapped at New Ulm; and on June 13 in North Dakota, with 1,248 at Fargo. During the month of June, however, spore showers were frequent, there being six periods in which spores were precipitated over the Dakotas and Minnesota. Rain fell in some part or all of the spring wheat area on most of the days on which spore showers were noted. Two periods followed in the first 10 days of July. This would appear to constitute as nearly continuous bombardment as might be expected. Although the spore load was not so heavy at a given time as was true in general in 1937, the total number of spores trapped during the season probably was larger.

Slide exposures in the past have indicated that few or no spores are to be found on slides exposed in Montana; this year, however, they occurred in quantity on July 9--over 10,000 per square foot of surface. Numbers found subsequently were smaller. The extension of the epidemic into northeastern Montana already has been mentioned.

The leaf rust epidemic also was reflected in the number of spores of this rust found on slides. Spores appeared on slides earlier in Missouri and Nebraska than in the past 3 years and were present on most slides. Leaf rust in quantity on Nebraska slides was first noted in 1936 on May 31, in 1937 on May 24, and in 1938 on May 2 and 3. The number on May 2-3 was about six times as heavy as on May 24 of the previous year.

Spring Wheat Area

Spring grains at the time of rust inoculation were in optimum condition for the development of infection. On June 1, according to "Crops and Markets" of the U. S. Department of Agriculture, spring grains were thriving, their condition being higher than on any June 1 since 1923. There was heavy growth of grain in Minnesota and in sections elsewhere in the spring wheat area. During June temperatures were normal or slightly above, but precipitation was uneven and in some sections insufficient for the crop. Above-average rainfall fell in southeastern Minnesota, in the middle division of South Dakota, and in the western third of North Dakota. In North Dakota showers were frequent after the 9th, and at the close of the month soil conditions in the State were good. In the northern two-thirds of Minnesota, however, moisture was needed by this time, and in western South Dakota and in the upper James Valley there was only from 6 to 10 inches depth of moisture. Temperatures during July were slightly above normal, and where there was enough rain the conditions were very favorable for rust development. Temperatures averaged from 84° to 87° F. at Minnesota stations in the grain area of the State and from 81° to 86° at North Dakota stations. During the first week of July showers were frequent. Rain fell at all North Dakota stations on July 1, 3, 4, and 5, and at some stations every day between July 1 and 11. Rainfall for the month was 137 percent of normal, in comparison with 77 and 78 percent of normal in South Dakota in June and July.

Under these conditions, therefore, heavy rust developed by harvest time throughout the spring wheat area, with the exception of those areas where moisture was deficient or other factors operated to prevent rust development, or where resistant varieties of wheat predominated. Drought prevented rust losses in western South Dakota and in some eastern sections; this was true also of south-central North Dakota and a tier of counties just west of the Red River Valley counties. In addition, grasshoppers caused so much damage in southern and southwestern North Dakota as almost to nullify stem rust. In Minnesota the preponderance of Thatcher wheat kept the aggregate rust loss low. Rust was destructively severe, on the other hand, in North Dakota except as noted, reaching almost maximum severity in the southern Red River Valley, in Pembina County of the northeast, and in sections of northwestern North Dakota. In South Dakota the heaviest infection occurred in the south-central section from Aurora County west to Tripp and Lyman Counties and farther north from western Spink County to Potter County. Durum wheats escaped heavy loss because of their comparative resistance to the most prevalent rust strain.

Physiologic-Race Survey

The stem rust epidemic in 1938 was caused primarily by physiologic race 56, which was the most prevalent race for the fifth consecutive year. This race was isolated from 83 percent of all the collections obtained in the United States and constituted about 66 percent of the isolates. In reality, probably upwards of 90 percent of the inoculum was of race 56. Never before, since the physiologic survey was started on an adequate scale, has any single rust race been so predominant as race 56. When a single race predominates as did 56 in 1938, this fact must be taken into consideration in explaining varietal behavior. Obviously the durum wheats, most varieties of which are highly resistant to 56, would tend to escape damage in a year like 1938; and there was very little rust on them, except on an occasional field of Kubanka, which, however, constitutes a relatively small percentage of the total. Furthermore, Thatcher wheat, now so commonly grown in the spring wheat regions, is moderately to highly resistant to race 56 and escaped infection almost entirely in 1938, while Ceres, Marquis, and certain other spring wheat varieties were virtually ruined by rust in many localities. It should be emphasized that too much dependence cannot be placed on the results of testing varieties against rust in a year like 1938 unless an artificial epidemic is produced with a number of the physiologic races. Under natural conditions the results of the survey show very clearly that the varieties or hybrids would be tested for practical purposes only against race 56.

Although four other races were fairly widely distributed and quite prevalent, they were not nearly so abundant as race 56. They are given in order of prevalence. Race 38 was identified in 15.5 percent of all uredial isolations, race 19 in 6.4 percent, race 17 in 3 percent, and race 11 in 2 percent. It is important to note that all four of these races attack durum wheats. Nevertheless there was very little rust on the most commonly grown varieties of durum in North Dakota. It should be explained that the percentage of isolates as given for the different races merely indicates the number of times this race was isolated from rust collections, and it does not show the percentage of rust in that collection belonging to the different isolates. Frequently two or more races are obtained in the same collection, and the relative amounts of the different races also is important. Quite often, for example, races 56 and 38 were identified from the same material, and race 56 often constituted 90 percent or more of the inoculum.

Collections of rust on barberry yielded the wheat strain of rust in most cases; 78 percent were _Puccinia graminis tritici_, 19 percent were _P. graminis secalis_, and 12.5 percent were _P. graminis avenae_. These

percentages indicate a decrease in the prevalence of the rye strain and an increase in the oats strain. Race 56 was most commonly isolated from barberries, as it was from wheat.

In the identification of races of *Puccinia graminis tritici* from barberries, those most commonly isolated were as follows: Race 56 occurred in 36.2 percent of aecial isolations, 38 in 9.9 percent, 36 in 7.3 percent, 17 in 7.3 percent, 19 in 6.5 percent, 34 in 6.1 percent, 21 in 5.3 percent, 49 in 4.9 percent, and 11 in 4.2 percent.

CROP LOSSES FROM PLANT DISEASES IN THE UNITED STATES IN 1938

Compiled by

H. A. Edson and Jessie I. Wood

Plant Disease Reporter
Supplement 118

December 31, 1939

CONTENTS

WHEAT

Table 1. Estimated reduction in yield from scab (*Gibberella zeae*), leaf rust (*Puccinia rubigo-vera tritici*), stem rust (*P. graminis*), bunt (*Tilletia* spp.) loose smut (*Ustilago tritici*), foot rots (various fungi), and other diseases, 1938.

State	Production	Scab		Leaf rust		Stem rust		Bunt		Loose smut		Foot rots		All diseases	
	1,000 bushels	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels
*Maine	68	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. Y.	7,533	1.	125	25.	3,113	5.	623	3.	374	1.	125	0.5	62	39.5	4,921
*N. J.	1,342	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pa.	22,032	0.1	27	10.	2,713	2.5	678	2.5	678	1.7	461	t	+	18.8	5,100
N.Atl.	30,975	0.4	152	14.7	5,826	3.3	1,301	2.7	1,052	1.5	586	0.2	62	25.4	10,021
Ohio	46,420	0.5	242	2.5	1,211	t	+	1.	485	0.2	97	t	+	4.2	2,035
Ind.	30,240	1.	318	3.	955	t	+	t	+	1.	318	-	-	5.	1,591
Ill.	42,550	1.2	662	15.	8,278	2.	1,104	t	+	2.	1,104	-	-	22.9	12,638
Mich.	19,519	0.3	60	0.1	20	1.	201	1.	201	0.1	20	0.1	20	3.	602
Wis.	2,007	1.	22	t	+	7.7	172	1.	22	0.2	4	t	+	9.9	220
Minn.	38,948	7.	3,325	8.	3,800	t	+	t	+	0	0	3.	1,425	18.	8,550
Iowa	9,586	5.	831	28.	4,652	1.	166	1.	166	1.	166	5.	831	42.3	7,029
Mo.	31,600	-	-	20.	8,427	5.	2,107	-	-	-	-	-	-	25.	10,534
N. D.	79,839	0.3	271	2.	1,804	6.2	5,593	0.5	451	0.5	451	2.	1,804	11.5	10,374
S. D.	27,777	-	-	-	-	3.1	889	-	-	-	-	-	-	3.1	889
Nebr.	55,714	-	-	20.	14,857	5.	3,714	-	-	-	-	-	-	25.	18,571
Kans.	152,184	t	+	12.	21,741	3.	5,435	0.5	906	0.5	906	-	-	16.	28,988
N.Cent.	536,384	0.9	5,731	10.3	65,745	3.	19,381	0.3	2,231	0.5	3,066	0.6	4,080	16.0	102,021
*Del.	1,660	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Md.	9,420	1.	102	2.	204	t	+	1.5	153	2.	204	0	0	7.5	765
Va.	8,526	3.	334	5.	557	5.	557	2.5	279	1.	111	1.	111	23.5	2,617
W. Va.	2,340	-	-	-	-	1.	24	-	-	-	-	-	-	1.	24
N. C.	5,440	2.	124	2.	124	-	-	1.	62	1.	62	1.	62	12.5	776
*S. C.	1,771	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ga.	1,700	-	-	25.	583	0.1	2	-	-	2.	47	-	-	27.1	632
S.Atl.	30,857	1.7	560	4.5	1,468	1.8	583	1.5	494	1.3	424	0.5	173	14.9	4,814

Wheat (Continued).

State	Production: 1,000 Bushels	Scab: %	Scab: 1,000 Bushels	Leaf rust: %	Leaf rust: 1,000 Bushels	Stem rust: %	Stem rust: 1,000 Bushels	Bunt: %	Bunt: 1,000 Bushels	Loose smut: %	Loose smut: 1,000 Bushels	Foot rots: %	Foot rots: 1,000 Bushels	All diseases: %	All diseases: 1,000 Bushels
Ky.	8,280	t	+	4.	385	t	+	1.	96	2.	193	-	-	14.	1,348
Tenn.	5,401	5.	365	20.	1,460	t	+	1.	73	t	+	-	-	26.	1,898
*Ala.	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ark.	595	t	+	30.	259	t	+	t	+	1.	9	-	-	31.	268
Okla.	58,322	-	-	27.	22,988	t	+	2.	1,703	2.5	2,129	t	+	31.5	26,820
Tex.	35,046	-	-	5.	1,856	0.6	223	-	-	-	-	-	-	5.6	2,079
S.Cent.	107,709	0.3	365	19.2	26,948	0.2	223	1.3	1,872	1.7	2,331	-	-	23.1	32,413
Mont.	72,349	0	0	t	+	5.	3,848	1.	770	t	+	t	+	6.	4,618
Idaho	29,843	0	0	t	+	1.	308	2.	615	t	+	-	-	3.	923
Wyo.	4,515	0	0	0.5	23	t	+	1.	46	-	-	-	-	1.5	69
Colo.	19,415	0	0	2.	467	.4	93	4.5	1,051	-	-	10.	2,336	16.9	3,947
*N.M.	2,680	0	0	-	-	-	-	-	-	-	-	-	-	-	-
*Ariz.	1,100	0	0	-	-	-	-	-	-	-	-	-	-	-	-
*Utah	6,573	0	0	-	-	-	-	-	-	-	-	-	-	-	-
*Nev.	453	0	0	-	-	-	-	-	-	-	-	-	-	-	-
Wash.	51,643	0	0	0.1	54	0.3	162	2.	1,080	t	+	1.6	864	4.4	2,376
Ore.	23,567	0	0	0.2	49	t	+	1.	244	t	+	1.8	439	3.4	830
*Calif.	12,733	0	0	-	-	-	-	-	-	-	-	-	-	-	-
Far West	224,876	0	0	0.3	593	2.1	4,411	1.8	3,806	-	-	1.7	3,639	6.0	12,763
U.S.	930,801	0.7	6,808	9.6	100,580	2.5	25,899	0.9	9,455	0.6	6,407	0.8	7,954	15.5	162,532

*Omitted from calculations for U. S. and section percentage loss.

Percentage of total listed production in States reporting, 97.

Table 2. Estimated reduction in yield from stripe (Helminthosporium gramineum), foot rot and seedling blight (various organisms), loose smut (Ustilago spp.), covered smut (U. hordei).

State	Production 1,000 Bushels	Estimated reduction in yield due to diseases							
		Stripe		Foot rots		Loose smut		Covered smut	
		%	1,000 Bushels	%	1,000 Bushels	%	1,000 Bushels	%	1,000 Bushels
*Maine	116	-	-	-	-	-	-	-	-
*Vermont	145	-	-	-	-	-	-	-	-
New York	4,307	5.	329	-	-	2.5	164	2.	132
*New Jersey	62	-	-	-	-	-	-	-	-
Pa.	2,036	0.2	5	-	-	4.8	111	4.	93
N. Atlantic	6,666	4.2	334	-	-	3.5	275	2.8	225
Ohio	700	-	-	-	-	-	-	-	-
Indiana	500	t	+	-	-	t	+	t	+
Illinois	4,650	t	+	-	-	0.2	11	0.5	27
Michigan	4,565	0.1	5	0.1	5	0.1	5	0.2	9
Wisconsin	24,286	0.5	131	t	+	1.	262	1.2	314
Minnesota	48,020	t	+	1.	493	t	+	0.5	246
Iowa	12,963	0.1	17	10.	1,699	0.5	85	2.5	425
*Missouri	1,938	-	-	-	-	-	-	-	-
N. D.	21,318	-	-	0.5	110	0.1	22	0.8	176
*S. D.	28,930	-	-	-	-	-	-	-	-
Nebraska	21,526	-	-	-	-	-	-	-	-
Kansas	6,681	t	+	-	-	1.	69	1.5	104
N. Central	176,077	0.1	153	1.5	2,307	0.3	454	0.8	1,301
Maryland	1,250	t	+	-	-	3.	41	3.	41
Virginia	1,320	2.	32	0.5	8	2.5	41	3.	49
*W. Va.	140	-	-	-	-	-	-	-	-
N. C.	190	3.	6	1.	2	1.	2	1.	2
S. Atlantic	2,900	1.2	38	0.3	10	2.6	84	2.9	92
*Kentucky	936	-	-	-	-	-	-	-	-
Tennessee	792	-	-	-	-	5.	47	10.	93
Oklahoma	3,420	t	+	1.	36	2.	73	3.	109
*Texas	2,363	-	-	-	-	-	-	-	-
S. Central	7,511	-	-	-	36	2.6	120	4.4	202
Montana	3,828	0.1	4	t	+	t	+	1.	39
Idaho	4,644	t	+	-	-	-	-	t	+
Wyoming	1,716	t	+	-	-	t	+	1.	17
Colorado	11,985	-	-	5.	638	t	+	1.	128
*N. M.	168	-	-	-	-	-	-	-	-
*Arizona	806	-	-	-	-	-	-	-	-
*Utah	2,542	-	-	-	-	-	-	-	-
*Nevada	260	-	-	-	-	-	-	-	-
Washington	2,080	0.1	2	0.7	15	0.2	4	0.2	4
Oregon	3,400	t	+	0.7	25	-	-	0.1	4
*California	27,550	-	-	-	-	-	-	-	-
Far Western	58,985	t	6	2.4	678	t	4	0.7	192
U. S.	252,139	0.3	531	1.5	3,031	0.5	937	1.3	2,012

*Omitted in calculations for United States and section percentage loss.

Percentage of total listed production in States reporting, 74.

Table 2 (Continued). Scab (Gibberella zeae), powdery mildew (Erysiphe graminis), leaf rusts (Puccinia anomala and P. rubigo-vera tritici), stem rust (P. graminis), and other diseases, 1938.

State	Estimated reduction in yield due to diseases									
	Scab		Powdery Mildew		Leaf rusts		Stem rust		All diseases	
	%	1,000 Bushels	%	1,000 Bushels	%	1,000 Bushels	%	1,000 Bushels	%	1,000 Bushels
Maine	-	-	-	-	-	-	-	-	-	-
Vermont	-	-	-	-	-	-	-	-	-	-
New York	t	+	10.	658	10.	658	5.	329	34.5	2,270
New Jersey	-	-	-	-	-	-	-	-	-	-
Pa.	t	+	0.2	5	1.	23	t	+	12.2	283
N. Atlantic	t	+	8.4	663	8.6	681	4.2	329	32.3	2,553
Ohio	-	-	-	-	-	-	t	+	t	+
Indiana	t	+	t	+	t	+	t	+	t	+
Illinois	6.	321	0.5	27	5.	268	1.	54	13.2	708
Michigan	0.3	14	-	-	-	-	t	+	0.9	43
Wisconsin	2.5	654	1.	262	0	0	t	+	7.2	1,885
Minnesota	0.5	246	-	-	t	+	0.5	246	2.5	1,231
Iowa	5.0	850	1.5	255	2.1	357	1.	170	23.7	4,028
Missouri	-	-	-	-	-	-	t	+	-	-
N. D.	-	-	0	0	-	-	1.	220	3.	660
S. D.	-	-	-	-	-	-	t	+	-	-
Nebraska	-	-	-	-	1.	220	1.	220	2.	440
Kansas	-	-	-	-	t	+	1.	69	3.5	242
N. Central	1.3	2,085	0.4	544	0.5	345	0.6	979	6.	9,237
Maryland	1.5	20	t	+	-	-	t	+	7.5	102
Virginia	2.	32	2.5	41	3.	49	2.	32	18.5	300
W. Va.	-	-	-	-	-	-	-	-	-	-
N. C.	0.5	1	1.	2	1.	2	-	-	9.5	19
S. Atlantic	1.7	53	1.4	43	1.6	51	1.	32	13.3	421
Kentucky	-	-	-	-	-	-	-	-	-	-
Tennessee	-	-	-	-	-	-	-	-	15.	140
Oklahoma	-	-	t	+	t	+	t	+	6.	218
Texas	-	-	-	-	-	-	-	-	-	-
S. Central	-	-	-	-	-	-	-	-	7.8	358
Montana	0	0	-	-	-	-	t	+	1.1	43
Idaho	0	0	t	+	-	-	t	+	t	+
Wyoming	0	0	-	-	-	-	t	+	1.	17
Colorado	0	0	-	-	-	-	t	+	6.	766
New Mexico	0	0	-	-	-	-	-	-	-	-
Arizona	0	0	-	-	-	-	-	-	-	-
Utah	0	0	-	-	-	-	-	-	-	-
Nevada	0	0	-	-	-	-	-	-	-	-
Washington	-	-	0.8	17	t	+	0.1	2	3.9	82
Oregon	-	-	0.6	21	t	+	t	+	3.	107
California	-	-	-	-	-	-	-	-	-	-
Far Western	-	-	0.1	38	-	-	t	2	3.5	1,015
U. S.	1.1	2,138	0.6	1,288	0.8	1,577	0.7	1,342	6.9	13,584

RYE

Table 3. Estimated reduction in yield from smut (Urocystis occulta), ergot (Claviceps purpurea), leaf rust (Puccinia rubigo-vera secalis).

State	Production 1,000 Bushels	Estimated reduction in yield due to diseases					
		Smut		Ergot		Leaf rust	
		%	1,000 Bushels	%	1,000 Bushels	%	1,000 Bushels
Massachusetts	-	-	-	t	+	t	+
New York	323	t	+	t	+	-	-
Pennsylvania	884	t	+	t	+	3.	29
*Ohio	351	-	-	-	-	-	-
*Indiana	1,265	-	-	-	-	-	-
*Illinois	1,269	-	-	-	-	-	-
Michigan	1,552	0.1	2	0.1	2	0.1	2
Wisconsin	4,290	0	0	2.	88	0.5	22
Minnesota	9,846	0	0	1.	99	0	0
Iowa	1,566	0	0	0.5	9	0.1	2
*Missouri	340	-	-	-	-	-	-
North Dakota	12,974	-	-	t	+	-	-
*South Dakota	10,176	-	-	-	-	-	-
*Nebraska	4,796	-	-	-	-	-	-
*Kansas	682	-	-	-	-	-	-
*Delaware	98	-	-	-	-	-	-
*Maryland	175	-	-	-	-	-	-
Virginia	437	0.1	+	0.1	+	1.	5
*West Virginia	88	-	-	-	-	-	-
North Carolina	406	-	-	-	-	-	-
*South Carolina	81	-	-	-	-	-	-
Georgia	114	-	-	-	-	1.	1
*Kentucky	225	-	-	-	-	-	-
*Tennessee	273	-	-	-	-	t	+
Oklahoma	340	-	-	-	-	3.	11
*Texas	42	-	-	-	-	-	-
Montana	592	-	-	t	+	-	-
*Idaho	96	-	-	-	-	-	-
*Wyoming	195	-	-	-	-	-	-
*Colorado	348	-	-	-	-	-	-
*Utah	36	-	-	-	-	-	-
Washington	110	-	-	-	-	t	+
Oregon	625	-	-	-	-	t	+
*California	70	-	-	-	-	-	-
United States	55,039	t	2	0.6	198	0.2	72

*Omitted from calculations for United States percentage loss.

Percentage of total listed production in States reporting, 62.

RYE (Continued)

Table 3 (Continued). Stem rust (Puccinia graminis), foot rot and seedling blights (various organisms), anthracnose (Colletotrichum graminicola), and other diseases, 1938.

State	Stem rust %	Stem rust 1,000 Bushels	Foot rots %	Foot rots 1,000 Bushels	Anthracnose %	Anthracnose 1,000 Bushels	All diseases %	All diseases 1,000 Bushels
Massachusetts	1.	+	5.	+	-	-	7.	+
New York	1.	3	t	+	-	-	1.	3
Pennsylvania	0.5	5	-	-	4.	38	7.5	72
Ohio	t	+	-	-	-	-	-	-
Indiana	t	+	-	-	-	-	-	-
Illinois	t	+	-	-	-	-	-	-
Michigan	t	+	-	-	0.1	2	0.4	8
Wisconsin	0	0	t	+	t	+	2.5	110
Minnesota	0	0	t	+	-	-	1.	99
Iowa	1.	18	10.	177	0.1	2	11.7	208
Missouri	0	0	-	-	-	-	-	-
North Dakota	0	0	t	+	-	-	t	+
South Dakota	0	0	-	-	-	-	-	-
Nebraska	t	+	-	-	-	-	-	-
Kansas	-	-	-	-	-	-	-	-
Delaware	-	-	-	-	-	-	-	-
Maryland	-	-	-	-	-	-	-	-
Virginia	1.	5	0.5	2	0.1	+	2.8	12
West Virginia	-	-	-	-	-	-	-	-
North Carolina	0.5	2	5.	23	2.	9	10.5	48
South Carolina	-	-	-	-	-	-	-	-
Georgia	-	-	-	-	-	-	1.	1
Kentucky	-	-	-	-	-	-	-	-
Tennessee	-	-	-	-	-	-	-	-
Oklahoma	1.	4	-	-	-	-	4.	15
Texas	-	-	-	-	-	-	-	-
Montana	0	0	t	+	-	-	t	+
Idaho	-	-	-	-	-	-	-	-
Wyoming	0	0	-	-	-	-	-	-
Colorado	-	-	-	-	-	-	-	-
Utah	-	-	-	-	-	-	-	-
Washington	t	+	-	-	-	-	t	+
Oregon	t	+	t	+	-	-	t	+
California	-	-	-	-	-	-	-	-
United States	0.1	37	0.6	202	0.1	51	1.7	576

Table 4. Estimated reduction in yield from loose smut (Ustilago avenae), covered smut (U. levis), stem rust (Puccinia graminis).

State	Production 1,000 Bushels	Estimated reduction in yield due to diseases: Loose smut %	Loose smut 1,000 Bushels	Covered smut %	Covered smut 1,000 Bushels	Stem rust %	Stem rust 1,000 Bushels
*Maine	3,876	t	+	-	-	-	-
*New Hampshire	288	-	-	-	-	-	-
*Vermont	1,736	-	-	-	-	-	-
Massachusetts	204			12.	31	1.	3
*Rhode Island	60	-	-	-	-	-	-
*Connecticut	180	-	-	-	-	-	-
New York	26,588	3.5	1,443			2.	824
*New Jersey	1,224	-	-	-	-	-	-
Pennsylvania	30,652	14.	5,304			3.	1,137
N. Atlantic	64,808	8.5	6,747		31	2.5	1,964
Ohio	36,993	1.	383	1.	383	t	+
Indiana	34,060	1.	351	1.	351	t	+
Illinois	110,534	1.5	2,431	2.2	3,566	10.	16,207
Michigan	42,840	0.3	130	0.2	87	0.5	217
Wisconsin	76,105	5.	5,285	3.	3,171	t	+
Minnesota	128,700	2.	2,860			t	+
Iowa	198,086	3.5	11,892	0.5	1,699	0.5	1,699
Missouri	45,600	-	-	-	-	1.	461
North Dakota	31,298	0.5	159	0.5	159	0	0
*South Dakota	46,050	-	-	-	-	t	+
*Nebraska	55,076	-	-	-	-	t	+
Kansas	35,673	2.3	1,029	-	-	3.	1,343
N. Central	841,015	2.5	24,520	1.0	9,416	2.0	19,927
*Delaware	96	-	-	-	-	-	-
Maryland	1,312	5.	71			t	+
Virginia	1,978	3.	69	3.5	81	4.	92
*West Virginia	1,806	-	-	-	-	0	0
North Carolina	5,566	1.	59	-	-	-	-
*South Carolina	10,648	-	-	-	-	-	-
Georgia	9,585	3.	303	-	-	-	-
*Florida	140	-	-	-	-	-	-
S. Atlantic	31,131	2.5	502	-	81	0.5	92
*Kentucky	1,209	-	-	-	-	-	-
Tennessee	1,700	3.	53	-	-	-	-
*Alabama	3,168	-	-	-	-	-	-
*Mississippi	1,593	-	-	-	-	-	-
Arkansas	2,565	1.	33	1.	33	t	+
*Louisiana	1,350	-	-	-	-	-	-
Oklahoma	27,447	8.	2,495	2.	624	t	+
*Texas	36,920	-	-	-	-	t	+
S. Central	75,952	-	2,581	-	657	-	-
Montana	8,928	0.1	9	0.1	9	0	0
Idaho	4,914	t	+	t	+	-	-
Wyoming	3,078	t	+	1.	31	0	0
*Colorado	5,953	t	+	-	-	0	0
*New Mexico	660	-	-	-	-	-	-
*Arizona	260	-	-	-	-	-	-
*Utah	1,092	-	-	-	-	-	-
*Nevada	120	-	-	-	-	-	-
Washington	6,715	0.1	7	0.2	14	0.4	28
Oregon	6,725	t	+	0.1	7	0.2	14
*California	3,388	-	-	-	-	-	-
Far Western	40,933	-	16	-	63	-	42
United States	1,053,839	3.0	34,366	1.0	10,246	1.9	22,025

*Omitted in calculations for United States and section percentage loss.
Percentage of total listed production in States reporting, 83.

OATS (Continued)

Table 4 (Continued). Crown rust (*Puccinia coronata*), foot and root rots (*Fusarium*, *Pythium*), blast (non-parasitic), and other diseases, 1938.

State	Crown rust %	Crown rust 1,000 Bushels	Foot & root rots[a] %	Foot & root rots[a] 1,000 Bushels	Blast %	Blast 1,000 Bushels	All diseases %	All diseases 1,000 Bushels
Maine	-	-	-	-	-	-	-	-
N. H.	-	-	-	-	-	-	-	-
Vermont	-	-	-	-	-	-	-	-
Mass.	2.	5	5.	13	-	-	21.	55
R. I.	-	-	-	-	-	-	-	-
Conn.	-	-	-	-	-	-	-	-
N. Y.	25.	10,306	-	-	5.	2,061	35.5	14,634
N. J.	-	-	-	-	-	-	-	-
Pa.	0.1	38	-	-	1.	379	19.1	7,237
N. Atlantic	13.	10,349	-	13	3.1	2,440	27.6	21,926
Ohio	1.5	575	-	-	-	-	3.5	1,341
Indiana	1.	351	-	-	t	+	3.	1,053
Illinois	2.5	4,052	-	-	15.	24,311	31.8	51,539
Michigan	0.1	43	0.1	43	-	-	1.4	607
Wisconsin	20.	21,140	0	0	0	0	28.	29,596
Minnesota	8.	11,440	t	+	-	-	10.	14,300
Iowa	24.	81,545	12.5	42,471	.5	1,699	41.7	141,685
Missouri	-	-	-	-	-	-	1.	461
N. D.	0.5	159	-	-	0	0	1.5	477
S. D.	-	-	-	-	-	-	-	-
Nebraska	-	-	-	-	-	-	-	-
Kansas	15.	6,714	-	-	-	-	20.3	9,086
N. Central	12.7	126,019	4.3	42,514	2.6	26,010	25.3	250,145
Delaware	-	-	-	-	-	-	-	-
Maryland	3.	43	-	-	-	-	8.	114
Virginia	3.	69	t	+	0.5	12	14.	323
W. Va.	-	-	-	-	-	-	-	-
N. C.	1.	59	0.5	29	-	-	5.5	324
S. C.	-	-	-	-	-	-	-	-
Georgia	2.	202	-	-	-	-	5.	505
Florida	-	-	-	-	-	-	-	-
S. Atlantic	1.9	373	-	29	-	12	6.3	1,266
Kentucky	-	-	-	-	-	-	-	-
Tennessee	-	-	-	-	-	-	3.	53
Alabama	-	-	-	-	-	-	-	-
Mississippi	-	-	-	-	-	-	-	-
Arkansas	20.	658	-	-	t	+	22.	724
Louisiana	-	-	-	-	-	-	-	-
Oklahoma	2.	624	-	-	-	-	12.	3,743
Texas	t	+	-	-	-	-	-	-
S. Central	-	1,282	-	-	-	-	-	4,520
Montana	0	0	0.1	9	0.1	9	0.5	45
Idaho	-	-	-	-	-	-	t	+
Wyoming	-	-	-	-	-	-	1.	31
Colorado	-	-	-	-	-	-	-	-
N. M.	-	-	-	-	-	-	-	-
Arizona	-	-	-	-	-	-	-	-
Utah	-	-	-	-	-	-	-	-
Nevada	-	-	-	-	-	-	-	-
Washington	0.9	63	1.6	112	-	-	4.1	287
Oregon	0.8	56	2.	140	-	-	4.	280
Calif.	-	-	-	-	-	-	-	-
Far Western	-	119	-	261	-	9	-	643
U. S.	11.9	138,142	0.2	2,045	2.5	28,471	24.2	276,500

[a] Fusarium, except Iowa: Pythium 12 percent, 40,772,000 bu.; Fusarium 0.5 percent, 1,699,000 bu.

FIELD CORN

Table 5. Estimated reduction in yield due to smut (<u>Ustilago zeae</u>), foot rots (various organisms), stalk and ear rot (<u>Diplodia zeae</u>).

State	Production 1,000 Bushels	Estimated reduction in yield due to diseases: Smut %	Smut 1,000 Bushels	Foot rots %	Foot rots 1,000 Bushels	Diplodia %	Diplodia 1,000 Bushels
*Maine	440	-	-	-	-	-	-
*New Hampshire	656	-	-	-	-	-	-
*Vermont	3,120	-	-	-	-	-	-
Massachusetts	1,482	2.	31	0.7	11	0.2	3
*Rhode Island	400	-	-	-	-	-	-
Connecticut	1,764	1.	18	-	-	-	-
New York	25,345	1.	256	-	-	-	-
*New Jersey	7,486	-	-	-	-	-	-
Pennsylvania	59,503	4.	2,675	2.	1,337	t	+
N. Atlantic	100,201	3.1	2,980	-	1,348	-	3
Ohio	156,992	0.5	863	2.	3,450	1.	1,725
Indiana	173,389	0.2	351	0.2	351	0.7	1,230
Illinois	379,350	1.5	7,597	-	-	12.	60,777
Michigan	58,035	1.	592	t	+	0.1	59
Wisconsin	90,514	2.	2,057	t	+	1.	1,029
Minnesota	157,535	4.	6,704	1.	1,676	-	-
Iowa	468,923	6.	37,020	12.	74,040	1.	6,170
*Missouri	106,500	-	-	-	-	-	-
North Dakota	16,186	2.	344	-	-	-	-
*South Dakota	35,688	-	-	-	-	-	-
*Nebraska	107,735	-	-	-	-	-	-
Kansas	45,200	2.	937	1.5	703	-	-
N. Central	1,796,047	3.	56,465	4.3	80,220	2.5	7[illegible],990
*Delaware	4,147	-	-	-	-	-	-
Maryland	18,537	1.5	306	4.	815	0.5	102
Virginia	34,775	1.	382	4.	1,529	1.	382
*West Virginia	12,640	-	-	-	-	-	-
North Carolina	46,398	2.	1,160	5.	2,900	2.	1,160
*South Carolina	26,767	-	-	-	-	-	-
Georgia	53,164	3.	2,127	1.	709	5.	3,544
*Florida	8,452	-	-	-	-	-	-
S. Atlantic	204,880	2.1	3,975	3.2	5,953	2.8	5,188
Kentucky	74,547	-	-	-	-	-	-
Tennessee	68,570	t	+	-	-	-	-
*Alabama	49,700	-	-	-	-	-	-
*Mississippi	48,544	-	-	-	-	-	-
*Arkansas	36,218	-	-	-	-	-	-
Louisiana	26,730	t	+	9.	2,881	1.5	480
Oklahoma	35,080	3.	1,156	3.	1,156	1.	385
Texas	75,648	t	+	-	-	-	-
S. Central	415,037	0.4	1,156	-	4,037	-	865
Montana	2,340	2.	48	-	-	-	-
Idaho	1,184	t	+	-	-	-	-
Wyoming	2,880	3.	89	-	-	-	-
Colorado	11,319	8.	1,191	16.	2,383	-	-
*New Mexico	2,606	-	-	-	-	-	-
*Arizona	495	-	-	-	-	-	-
*Utah	500	-	-	-	-	-	-
*Nevada	62	-	-	-	-	-	-
Washington	1,015	t	+	0.2	2	-	-
Oregon	1,595	t	+	0.3	5	-	-
*California	2,077	-	-	-	-	-	-
Far Western	26,073	5.5	1,328	9.9	2,390	-	-
United States	2,542,238	2.7	65,904	3.8	93,948	3.1	77,046

*Omitted in calculations for United States and section percentage loss.
Percentage of total listed production represented in reporting area, 98.2.

FIELD CORN (Continued)

Table 5 (Cont'd). Ear rots and stalk rots (various organisms, except *Diplodia*), bacterial wilt (*Aplanobacter stewarti*), and other diseases, 1938.

	Estimated reduction in yield due to diseases							
	Ear rots		Stalk rots		Bacterial wilt		All diseases	
State	%	1,000 Bushels	%	1,000 Bushels	%	1,000 Bushels	%	1,000 Bushels
Maine	-	-	-	-	-	-	-	-
New Hampshire	-	-	-	-	-	-	-	-
Vermont	-	-	-	-	-	-	-	-
Massachusetts	0.2	3	0.2	3	-	-	4.	62
Rhode Island	-	-	-	-	-	-	-	-
Connecticut	-	-	-	-	-	-	1.	18
New York	-	-	-	-	t	+	1.	256
New Jersey	-	-	-	-	-	-	-	-
Pennsylvania	4.	2,675	-	-	-	-	11.	7,356
N. Atlantic	-	2,678	-	3	-	-	8.	7,692
Ohio	0.5	863	-	-	5.	8,626	9.	15,527
Indiana	0.2	351	t	+	t	+	1.3	2,283
Illinois	4.1	20,765	t	+	5.	25,324	25.1	127,125
Michigan	0.3	178	0.2	118	0	0	2.	1,184
Wisconsin	4.	4,114	5.	5,143	0	0	12.	12,343
Minnesota	1.	1,676	t	+	0	0	6.	10,056
Iowa	3.	18,510	1.5	9,255	0.5	3,085	24.	148,080
Missouri	-	-	-	-	-	-	-	-
North Dakota	0.5	86	0.5	86	0	0	6.	1,033
South Dakota	-	-	-	-	0	0	-	-
Nebraska	-	-	-	-	0	0	-	-
Kansas	-	-	-	-	-	-	3.5	1,640
N. Central	2.5	46,543	0.8	14,602	2.	37,035	17.1	319,271
Delaware	-	-	-	-	-	-	-	-
Maryland	2.	407	1.	204	t	+	9.	1,834
Virginia	1.	382	t	+	t	+	9.	3,439
West Virginia	-	-	-	-	-	-	-	-
North Carolina	2.	1,160	2.	1,160	-	-	20.	11,600
South Carolina	-	-	-	-	-	-	-	-
Georgia	10.	7,089	5.	3,544	-	-	25.	17,722
Florida	-	-	-	-	-	-	-	-
S. Atlantic	4.8	9,038	2.6	4,908	-	-	18.5	34,595
Kentucky	1.	793	-	-	5.	3,965	6.	4,758
Tennessee	3.	2,121	t	+	-	-	3.	2,121
Alabama	-	-	-	-	-	-	-	-
Mississippi	-	-	-	-	-	-	-	-
Arkansas	-	-	-	-	-	-	-	-
Louisiana	6.	1,921	-	-	-	-	16.5	5,282
Oklahoma	1.	385	1.	385	-	-	9.	3,467
Texas	-	-	-	-	-	-	t	+
S. Central	1.8	5,220	-	385	-	3,965	5.3	15,628
Montana	-	-	-	-	0	0	2.	48
Idaho	t	+	-	-	0	0	t	+
Wyoming	-	-	-	-	0	0	3.	89
Colorado	-	-	-	-	0	0	24.	3,574
New Mexico	-	-	-	-	0	0	-	-
Arizona	-	-	-	-	0	0	-	-
Utah	-	-	-	-	0	0	-	-
Nevada	-	-	-	-	0	0	-	-
Washington	-	-	-	-	0	0	0.2	2
Oregon	-	-	-	-	0	0	0.3	13
California	-	-	-	-	-	-	-	-
Far Western	-	-	-	-	0	0	15.4	3,726
United States	2.6	63,479	0.8	19,898	1.7	41,000	15.5	380,912

SWEET CORN

Table 6. Estimated reduction in yield due to smut (Ustilago zeae), bacterial wilt (Aplanobacter stewarti), stalk and ear rots (Diplodia spp.), foot rots and seedling blights (Fusarium spp. and others), and other diseases, 1938.

State	Production: short tons	Smut: %	Smut: Short tons	Wilt: %	Wilt: Short tons	Diplodia: %	Diplodia: Short tons	Foot rots: %	Foot rots: Short tons	All Diseases: %	All Diseases: Short tons
*Maine	59,800	t	+	0	0	-	-	-	-	-	-
*New Hampshire	1,800	-	-	0	0	-	-	-	-	-	-
*Vermont	4,000	-	-	0	0	-	-	-	-	-	-
Mass.		3.	+	t	+	-	-	5.	+	9.	+
Conn.		1.	+	1.	+	-	-	-	-	2.	+
New York	66,000	3.	2,058	0.3	206	0.2	137	0.2	137	3.8	2,607
Pennsylvania	19,300	5.	1,084	3.	651	-	-	3.	651	11.	2,386
Ohio	45,800	0.5	236	2.5	1,182	0.1	47	-	-	3.1	1,465
Indiana	72,100	0.1	74	2.	1,473	t	+	-	-	2.1	1,547
*Illinois	146,400	-	-	-	-	-	-	-	-	-	-
Michigan	7,800	1.	79	0	0	0.1	8	0.1	8	1.5	119
Wisconsin	57,600	6.	3,677	0	0	t	+	t	+	6.	3,677
Minnesota	170,800	4.	7,268	0	0	1.	1,817	1.	1,817	6.	10,902
Iowa	82,500	8.	8,462	1.	1,058	3.	3,173	-	-	22.	23,270
N. D.		3.	+	0	0	-	-	-	-	3.	+
*Nebraska	4,000	-	-	-	-	-	-	-	-	-	-
*Delaware	6,000	-	-	-	-	-	-	-	-	-	-
Maryland	85,000	2.	1,809	1.	904	2.	1,809	1.	904	6.	5,426
*Tennessee	8,800	-	-	-	-	-	-	-	-	-	-
Oklahoma		10.	+	-	-	t	+	t	+	10.	+
Texas		t	+	t	+	-	-	-	-	t	+
Montana		2.	+	-	-	-	-	-	-	2.	+
Wyoming		4.	+	0	0	-	-	-	-	4.	+
Colorado		10.	+	0	0	-	-	15.	+	25.	+
Washington	7,000	t	+	0	0	-	-	t	+	t	+
Oregon	5,400	t	+	0	0	-	-	0.1	5	0.1	5
Other States	25,900										
U. S.	876,000	3.7	24,747	0.8	5,474	1.0	6,991	0.5	3,522	7.6	51,404

*Omitted in calculations for United States percentage loss.

Approximate percentage of total crop in reporting area, 71.

Table 7. Estimated reduction in yield due to stem rot (Fusarium bulbigenum batatas and F. oxysporum f. 2), black rot (Ceratostomella fimbriata), scurf (Monilochaetes infuscans), mottle necrosis (Pythium ultimum), soil rot (Actinomyces sp.), and other diseases, and estimated loss from storage rots, including soft rot (Rhizopus spp.), surface rot (Fusarium oxysporum), and others, 1938.

State	Production	Estimated reduction in yield due to diseases																	
		Stem rot		Black rot		Scurf		Mottle necrosis		Soil rot		All diseases		Soft rot		Surface rot		All rots	
	1000 bushels	%	1000 bushels	%	1000 bushels	%	1000 bushels	%	1000 bushels	%	1000 bushels	%	1000 bushels	%	1000 bushels	%	1000 bushels	%	1000 bushels
°*N.J.	1,470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pa.		0.5	+	t	+	-	-	-	-	t	+	2.	+	2.	+	1.	+	3.	+
Ind.	345	2.	7	-	-	-	-	-	-	-	-	2.	7	+	+	+	+	2.	7
°*Ill.	648	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iowa	300	20.	77	0.1	+	0	0	2.	8	0	0	22.2	85	8.	24	2.	16	10.	30
°*Mo.	1,020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kans.	375	5.	20	2.	8	t	+	-	-	1.	4	8.	32	2.	8	-	-	2.	8
•*Dela.	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Md.	1,040	4.	45	1.	11	t	+	t	+	2.	22	7.	78	+	+	+	+	10.	104
Va.	3,570	7.	281	2.	80	2.	80	-	-	-	-	11.	441	2.	71	1.	36	3.	107
N.C.	8,748	10.	1,006	1.	101	1.	101	1.	101	t	+	13.	1,309	10.	875	12.	1,050	34.	2,975
°*S.C.	6,468	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
° Ga.	9,225	10.	1,538	20.	3,075	-	-	-	-	-	-	40.	6,151	-	-	-	-	-	-
°*Fla.	1,400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
°*Ky.	2,280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tenn.	5,459	t	+	10.	607	-	-	-	-	-	-	10.	607	+	+	+	+	5.	273
°*Ala.	8,560	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
°*Miss.	7,743	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
°*Ark.	3,225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
La.	6,930	t	+	1.	73	t	+	-	-	5.	369	6.	442	2.	139	-	-	4.	278
Okla.	1,470	4.	66	4.	66	-	-	-	-	-	-	11.	182	2.	29	2.	29	6.	87
°*Tex.	4,350	-	-	t	+	-	-	-	-	t	+	-	-	-	-	-	-	-	-
°*Calif.	1,521	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U.S.	76,647	6.5	3,040	8.6	4,021	0.4	181	0.2	109	0.8	395	19.9	9,334	4.1	1,146	4.	1,131	13.6	3,669

* Omitted from calculations for U. S. percentage loss, for field loss; ° for storage rots.
Percentage of total listed production in 10 States reporting, 49.

Table 8. Estimated reduction in yield from mosaic, leaf roll, and other virus diseases (including purple top), late blight (Phytophthora infestans), rhizoctonia (Corticium vagum), blackleg (Bacillus phytophthorus).

State	Production 1,000 bushels	Estimated reduction in yield due to diseases: Virus diseases: Mosaic %	Mosaic 1,000 bushels	Leaf roll %	Leaf roll 1,000 bushels	Others %	Others 1,000 bushels	Late blight %	Late blight 1,000 bushels	Rhizoctonia %	Rhizoctonia 1,000 bushels	Blackleg %	Blackleg 1,000 bushels
Maine	39,600	-	-	4.	1,886	-	+	10.	4,714	-	-	1.	471
*New Hampshire	1,296	-	-	-	-	-	-	-	-	-	-	-	-
Vermont	1,884	2.5	123	5.	245	-	-	35.	1,717	5.	245	0.1	5
Massachusetts	2,041	3.	87	4.	117	-	-	8.	233	9.	262	0.1	3
*Rhode Island	624	-	-	-	-	-	-	-	-	-	-	-	-
Connecticut	2,310	-	-	-	-	-	-	10.	272	-	-	-	-
New York	26,840	2.	1,491	2.	1,491	t	+	45.	33,550	5.	3,728	t	+
*New Jersey	10,530	-	-	-	-	-	-	-	-	-	-	-	-
Pennsylvania	22,002	1.	315	5.	1,576	1.	315	15.	4,728	1.	315	0.2	63
N. Atlantic	107,127	1.2	2,016	3.2	5,315	0.2	315	27.6	45,214	2.8	4,550	0.3	542
Ohio	12,626	0.5	82	4.	654	0.1	16	5.	818	1.5	245	0.7	114
Indiana	4,940	t	+	t	+	t	+	t	+	4.	225	t	+
*Illinois	3,822	-	-	-	-	-	-	-	-	-	-	-	-
Michigan	30,000	0.1	40	0.1	40	0.1	40	5.	1,997	0.5	200	1.5	599
Wisconsin	19,080	1.	239	0.	0	6.	1,431	5.	1,193	t	+	1.	239
Minnesota	20,700	2.	618	-	-	9.	2,781	2.	618	3.	927	1.	309
Iowa	5,684	8.	671	7.	587	2.	168	0	0	3.	251	1.	84
*Missouri	5,832	-	-	-	-	-	-	-	-	-	-	-	-
North Dakota	9,750	1.	105	0.5	52	1.	105	0	0	1.	105	1.	105
*South Dakota	1,624	-	-	-	-	-	-	θ	θ	-	-	-	-
Nebraska	6,240	0.1	7	-	-	0.3	21	0	0	-	-	t	+
Kansas	3,219	-	-	-	-	4.	145	0	0	4.	145	t	+
N. Central	123,517	1.2	1,762	0.9	1,333	3.2	4,707	3.2	4,626	1.4	2,098	1.	1,450
*Delaware	368	-	-	-	-	-	-	-	-	-	-	-	-
Maryland	2,990	1.	37	2.5	93	0.5	19	10.	374	1.	37	0.5	19
Virginia	10,349	1.	164	8.	1,314	1.	164	20.	3,285	1.	164	1.	164
West Virginia	2,720					10.	419	10.	419	t	+	3.	126
North Carolina	8,690	5.	547	1.	109	-	-	3.	328	1.	109	1.	109
*South Carolina	2,784	-	-	-	-	-	-	-	-	-	-	-	-

State	Production 1,000 bushels	Mosaic %	Mosaic 1,000 bushels	Leaf roll %	Leaf roll 1,000 bushels	Others %	Others 1,000 bushels	Late blight %	Late blight 1,000 bushels	Rhizoctonia %	Rhizoctonia 1,000 bushels	Blackleg %	Blackleg 1,000 bushels
		Estimated reduction in yield due to diseases											
		Virus diseases											
Georgia	1,044	3.	40	-	-	-	-	-	-	-	-	5.	66
Florida	4,488	3.	157	2.	105	-	-	2.5	131	2.	105	0.3	16
S. Atlantic	33,433	2.3	945	3.9	1,621	1.4	602	10.8	4,537	1.	415	1.2	500
*Kentucky	4,635	-	-	-	-	-	-	-	-	-	-	-	-
Tennessee	3,120					5.	178	5.	178	t	+	t	+
*Alabama	4,326	-	-	-	-	-	-	-	-	-	-	-	-
*Mississippi	1,368	-	-	-	-	-	-	-	-	-	-	-	-
*Arkansas	3,400	-	-	-	-	-	-	-	-	-	-	-	-
Louisiana	2,752	5.	167					-	-	t	+	-	-
Oklahoma	2,376	3.	89	3.	89	3.	89	0	0	1.	30	1.	30
*Texas	2,950	t	+	t	+	-	-	-	-	-	-	-	-
S. Central	24,927	2.6	256	0.9	89	2.7	267	1.8	178	0.3	30	0.3	30
Montana	1,620	5.	121	0	0	1.	24	0	0	t	+	t	+
Idaho	28,750	4.	1,223	t	+	t	+	0	0	1.	306	1.	306
Wyoming	1,080	2.	56	-	-	1.	28	0	0	1.5	42	1.	28
Colorado	11,830	-	-	-	-	-	-	0	0	-	-	2.	376
*New Mexico	560	-	-	-	-	-	-	0	0	-	-	-	-
*Arizona	275	-	-	-	-	-	-	0	0	-	-	-	-
*Utah	2,244	-	-	-	-	-	-	0	0	-	-	-	-
*Nevada	336	-	-	-	-	-	-	0	0	-	-	-	-
Washington	7,568					10.	880	0.2	18	1.	88	0.2	18
*Oregon	7,310	-	-	-	-	-	-	-	-	-	-	-	-
*California	18,720	-	-	-	-	-	-	-	-	-	-	-	-
Far Western	80,293	2.2	1,400	-	-	1.5	932	t	18	0.7	436	1.1	728
United States	369,297	1.5	6,379	2.0	8,358	1.6	6,823	12.8	54,573	1.8	7,529	0.8	3,250

*Omitted from calculations for United States and section percentage loss.
Percentage of total listed production in States reporting, 80.

(continued, next page).

POTATO (continued)

Table 8 (cont'd). Estimated reduction in yield from fusarium wilt (*Fusarium* spp.), tipburn and hopperburn (non-parasitic and leafhoppers), early blight (*Alternaria solani*), bacterial ring rot (*Bacterium sepedonicum*), scab (*Actinomyces scabies*), psyllid yellows (due to psyllids), and other diseases, 1938.

State	Estimated reduction in yield due to diseases													
	Fusarium wilt		Tipburn and hopperburn		Early blight		Ring rot		Scab		Psyllid yellows		All diseases	
	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels	%	1,000 bushels
Maine	-	-	-	-	-	-	t	+	1.	471	0	0	16.	7,542
N. H.	-	-	-	-	-	-	-	-	-	-	θ	0	-	-
Vermont	-	-	10.	491	2.	98	-	-	2.	98	0	0	61.6	3,022
Mass.	-	-	3.	87	1.	29	-	-	0.2	6	0	0	30.	874
Rhode Island	-	-	-	-	-	-	-	-	-	-	0	0	-	-
Connecticut	-	-	-	-	-	-	-	-	-	-	0	0	15.	408
New York	t	+	6.	4,473	2.	1,491	-	-	2.	1,491	0	0	64.	47,715
New Jersey	-	-	-	-	-	-	-	-	-	-	0	0	-	-
Pennsylvania	t	+	1.	315	1.	315	t	+	5.	1,576	0	0	30.2	9,518
N. Atlantic	t	+	3.3	5,366	1.2	1,933	t	+	2.2	3,642	0	0	42.1	69,079
Ohio	1.	164	7.	1,145	2.	327	-	-	1.	164	0	0	22.8	3,729
Indiana	-	-	3.	169	0.1	6	-	-	5.	281	0	0	12.1	681
Illinois	-	-	-	-	-	-	-	-	-	-	θ	0	-	-
Michigan	0.5	200	5.	1,997	2.	799	-	-	10.	3,995	0	0	24.9	9,947
Wisconsin	t	+	2.	477	t	+	t	+	5.	1,193	0	0	20.	4,772
Minnesota	4.	1,236	10.	3,090	1.	309	t	+	1.	309	0	0	33.	10,197
Iowa	0.1	8	6.	503	0.1	8	-	-	4.	335	0	0	32.2	2,699
Missouri	-	-	-	-	-	-	-	-	-	-	0	0	-	-
North Dakota	1.	105	0.5	52	t	+	-	-	t	+	t	+	7.	734
South Dakota	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nebraska	6.	427	-	-	-	-	t	+	6.	427	-	-	12.4	882
Kansas	-	-	-	-	-	-	-	-	-	-	-	-	11.5	417
N. Central	1.5	2,140	5.1	7,433	1.	1,449	t	+	4.6	6,704	-	-	23.3	34,058
Delaware	-	-	-	-	-	-	-	-	-	-	θ	θ	-	-
Maryland	0.5	19	0.5	19	0.5	19	-	-	2.	75	0	0	20.	748
Virginia	-	-	-	-	1.	164	-	-	2.	329	0	0	37.	6,077
West Virginia	-	-	5.	209	1.	42	-	-	1.	42	0	0	35.	1,466
N. C.	1.	109	1.	109	0.5	55	-	-	1.	109	0	0	20.5	2,240
S. C.	-	-	-	-	-	-	-	-	-	-	θ	0	-	-

State	Fusarium wilt %	Fusarium wilt 1,000 bushels	Tipburn and hopperburn %	Tipburn and hopperburn 1,000 bushels	Early blight %	Early blight 1,000 bushels	Ring rot %	Ring rot 1,000 bushels	Scab %	Scab 1,000 bushels	Psyllid yellows %	Psyllid yellows 1,000 bushels	All diseases %	All diseases 1,000 bushels
	Estimated reduction in yield due to diseases													
Georgia	2.	26	-	-	1.	13	-	-	-	-	0	0	21.	277
Florida	-	-	-	-	t	+	1.	52	1.	52	0	0	14.3	749
S. Atlantic	0.4	154	0.8	337	0.7	293	-	52	1.5	607	0	0	27.7	11,557
Kentucky	-	-	-	-	-	-	-	-	-	-	0	0	-	-
Tennessee	-	-	1.	36	1.	36	-	-	0.5	18	0	0	12.5	446
Alabama	-	-	-	-	-	-	-	-	-	-	0	0	-	-
Mississippi	-	-	-	-	-	-	-	-	-	-	0	0	-	-
Arkansas	-	-	-	-	-	-	-	-	-	-	0	0	-	-
Louisiana	t	+	-	-	2.	67	-	-	0.5	17	0	0	17.5	585
Oklahoma	1.	30	-	-	-	-	-	-	3.	89	-	-	20.	595
Texas	-	-	-	-	t	+	-	-	t	+	-	-	-	-
S. Central	0.3	30	0.4	36	1.	103	-	-	1.3	124	-	-	15.5	1,626
Montana	1.	24	1.	24	t	+	-	-	t	+	25.	605	33.	798
Idaho	t	+	-	-	t	+	-	-	t	+	t	+	6.	1,835
Wyoming	3.	84	-	-	0.5	14	0.7	19	1.5	42	50.	1,392	61.2	1,705
Colorado	2.	376	-	-	-	-	25.	4,695	-	-	8.	1,502	37.	6,949
New Mexico	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arizona	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utah	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nevada	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Washington	0.2	18	-	-	0.2	18	-	-	1.	88	-	-	14.	1,234
Oregon	-	-	-	-	-	-	-	-	-	-	-	-	-	-
California	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Far Western	0.8	502	t	24	t	32	-	4,714	0.2	130	5.5	3,499	19.8	12,521
U. S.	0.7	2,826	3.1	13,196	0.9	3,810	1.1	4,766	2.6	11,207	0.8	3,499	30.3	128,841

TOMATOES: FOR MARKET

Table 9. Estimated reduction in yield due to septoria blight (*Septoria lycopersici*), fusarium wilt (*Fusarium bulbigenum lycopersici*), bacterial wilt (*Bacterium solanacearum*), early blight and nailhead spot (*Alternaria* spp.), root knot (*Heterodera marioni*).

State	Production 1,000 bushels	Estimated reduction in yield due to diseases									
		Septoria blight		Fusarium wilt		Bacterial wilt		Early blight		Root knot	
		%	1,000 bu.	%	1,000 bu.	%	1,000 bu.	%	1,000 bu.	%	1,000 bu.
Mass.		1.	+	-	-	0.1	+	10.	+	0	0
Connecticut		-	-	-	-	-	-	10.	+	0	0
New York	1,955	1.5	35	0	0	0	0	12.	280	0.1	2
*New Jersey	1,800	-	-	-	-	-	-	-	-	-	-
Pennsylvania	400	3.	14	0.1	+	-	-	7.	32	0.1	+
N. Atlantic	4,155	1.8	49	t	+	-	-	11.2	312	0.1	2
Ohio	369	10.	47	2.	9	-	-	5.	23	0.5	2
Indiana	540	5.	30	0.5	3	0.1	1	3.	18	-	-
*Illinois	113	-	-	-	-	-	-	-	-	-	-
Michigan	500	1.	5	5.	27	-	-	0.1	1	0.1	1
Wisconsin		10.	+	t	+	-	-	10.	+	-	-
Minnesota		t	+	t	+	-	-	-	-	-	-
Iowa	72	4.	3	t	+	-	-	1.	1	-	-
*Missouri	495	-	-	-	-	-	-	-	-	-	-
North Dakota		-	-	-	-	-	-	-	-	-	-
Kansas		5.	+	1.	+	-	-	-	-	-	-
N. Central	2,089	5.	85	2.3	39	0.1	1	2.6	43	0.2	3
*Delaware	18	-	-	-	-	-	-	-	-	-	-
Maryland	659	1.	7	1.5	11	-	-	5.	37	-	-
Virginia	288	1.	4	10.	37	2.	7	4.	15	t	+
W. Va.		-	-	2.	+	-	-	-	-	-	-
N. C.	130	1.	2	4.	7	6.	10	0.5	1	5.	8
*S. C.	360	-	-	-	-	-	-	-	-	-	-
Georgia	350	-	-	5.	26	1.	5	10.	52	2.	10
Florida	4,953	t	+	2.	108	2.	108	2.	108	-	-
S. Atlantic	6,758	0.2	13	2.6	189	1.8	130	3.	213	0.3	18
*Kentucky	196	-	-	-	-	-	-	-	-	-	-
Tennessee	819	50.	1,024	2.	41	-	-	5.	102	2.	41
*Mississippi	1,200	-	-	-	-	-	-	-	-	-	-
*Arkansas	298	-	-	-	-	-	-	-	-	-	-
Louisiana	239	-	-	1.	2	-	-	1.	2	-	-
Oklahoma		-	-	2.	+	2.	+	2.	+	5.	+
Texas	3,333	-	-	2.	69	-	-	t	+	t	+
S. Central	6,085	-	1,024	2.	112	-	-	1.8	104	0.7	41
Montana		0.2	+	3.	+	-	-	-	-	-	-
Idaho		-	-	-	-	-	-	-	-	-	-
Colorado	396	t	+	t	+	-	-	-	-	-	-
Utah	52	-	-	-	-	-	-	-	-	-	-
Washington	176	-	-	-	-	-	-	0.3	1	-	-
*Oregon	285	-	-	-	-	-	-	-	-	-	-
*California	4,316	-	-	-	-	-	-	-	-	-	-
Far Western	5,225	t	+	-	-	-	-	-	1	-	-
U. S.	24,312	6.5	1,171	1.9	340	0.7	131	3.7	673	0.4	64

* Omitted from calculations for United States and section percentage loss. Percentage of total listed production in reporting area, 63.

Table 9 (cont'd). Estimated reduction in yield due to blossom-end rot (non-parasitic), bacterial canker (Aplanobacter michiganense), mosaic, curly top, other virus diseases, and other diseases, 1938.

State	Estimated reduction in yield due to diseases: Blossom-end rot		Bacterial canker		Virus diseases: Mosaic		Curly top		Others		All diseases	
	%	1000 bu.	%	1000 bu.	%	1000 bu.	%	1000 bu.	%	1000 bu.	%	1000 bu.
Massachusetts	2.	+	0.1	+	1.	+	0	0	1.	+	16.	+
Connecticut	-	-	-	-	-	-	0	0	-	-	10.	+
New York	1.	23	0.2	5	1.	23	0	0	0.1	2	16.1	375
New Jersey	-	-	-	-	-	-	0	0	-	-	-	-
Pennsylvania	1.	5	t	+	1.	5	0	0	t	+	13.2	61
N. Atlantic	1.	28	0.2	5	1.	28	0	0	0.1	2	15.8	436
Ohio	1.	5	0.1	+	2.	9	0	0	t	+	21.1	97
Indiana	-	-	-	-	-	-	0	0	-	-	8.7	53
Illinois	-	-	-	-	-	-	0	0	-	-	-	-
Michigan	0.1	1	0.1	1	0.1	1	0	0	t	+	7.6	43
Wisconsin	t	+	1.	+	t	+	0	0	-	-	21.	+
Minnesota	-	-	-	-	-	-	0	0	t	+	t	+
Iowa	6.	5	t	+	2.	2	0	0	-	-	13.	11
Missouri	-	-	-	-	-	-	0	0	-	-	-	-
North Dakota	1.	+	-	-	1.	+	0	0	-	-	2.	+
Kansas	-	-	-	-	-	-	0	0	-	-	6.5	+
N. Central	0.7	11	0.1	1	0.7	12	0	0	t	+	12.2	204
Delaware	-	-	-	-	-	-	0	0	-	-	-	-
Maryland	-	-	0.5	4	-	-	0	0	1.	7	10.5	77
Virginia	-	-	-	-	2.	7	0	0	-	-	21.	77
West Virginia	3.	+	-	-	-	-	0	0	-	-	10.	+
N. C.	2.	3	-	-	1.	2	0	0	-	-	22.5	38
S. C.	-	-	-	-	-	-	0	0	-	-	-	-
Georgia	15.	78	-	-	-	-	0	0	-	-	33.	171
Florida	2.	108	-	-	t	+	0	0	-	-	8.	432
S. Atlantic	2.6	189	t	4	0.1	9	0	0	0.1	7	11.	795
Kentucky	-	-	-	-	-	-	0	0	-	-	-	-
Tennessee	-	-	-	-	-	-	0	0	1.	20	60.	1,228
Mississippi	-	-	-	-	-	-	0	0	-	-	-	-
Arkansas	-	-	-	-	-	-	0	0	-	-	-	-
Louisiana	t	+	-	-	2.	5	0	0	-	-	4.	9
Oklahoma	1.	+	1.	+	1.	+	0	0	-	-	14.	+
Texas	t	+	-	-	t	+	t	+	t	+	3.	103
S. Central	t	-	-	-	t	5	t	+	0.4	20	23.4	1,340
Montana	1.	+	-	-	0.2	+	0.2	+	-	-	10.	+
Idaho	t	+	-	-	t	+	15.	+	-	-	-	-
Colorado	-	-	10.	44	-	-	-	-	-	-	10.	44
Utah	-	-	5.	3	-	-	5.	3	-	-	20.[a]	13
Washington	0.3	1	0.3	1	0.3	1	25.	61	-	-	28.	69
Oregon	-	-	-	-	-	-	-	-	-	-	-	-
California	-	-	-	-	-	-	-	-	-	-	-	-
Far Western	0.1	1	6.4	48	0.1	1	8.5	64	-	-	16.7	126
United States	1.3	229	0.3	58	0.3	55	0.3	64	0.1	29	16.0	2,901

a/ Verticillium wilt (V. albo-atrum), 10 percent, 7000 bushels.

TOMATOES: FOR MANUFACTURE

Table 10. **Estimated reduction in yield** from septoria blight (Septoria lycopersici), fusarium wilt (Fusarium bulbigenum lycopersici), early blight (Alternaria solani), blossom-end rot (non-parasitic), bacterial canker (Aplanobacter michiganense), virus diseases, and other diseases, 1938.

State	Production short tons°	Septoria %	Septoria Short tons	Fusarium wilt %	Fusarium wilt Short tons	Early blight %	Early blight Short tons	Blossom-end rot %	Blossom-end rot Short tons	Bacterial canker %	Bacterial canker Short tons	Virus diseases %	Virus diseases Short tons	All diseases %	All diseases Short tons
New York	170,200	1.5	3,043	0	0	12.	24,343	1.	2,029	0.2	406	1.1	2,231	16.1	32,661
*N. J.	139,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pa.	83,700	3.	2,893	0.1	96	7.	6,750	1.	964	t	+	1.	964	13.2	12,728
N. Atl.	493,998	2.	5,936	t	96	10.4	31,093	1.	2,993	0.1	406	1.1	3,195	15.2	45,389
Ohio	146,900	10.	18,619	2.	3,724	5.	9,309	1.	1,862	0.1	186	2.	3,724	21.1	39,286
Indiana	304,900	5.	16,698	0.5	1,670	3.	10,019	-	-	-	-	-	-	8.7	29,055
*Illinois	38,700	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Michigan	36,000	1.	390	5.	1,948	0.1	39	0.1	39	0.1	39	1.1	429	7.6	2,962
Iowa	23,900	4.	1,099	t	+	1.	275	6.	1,648	t	+	2.	549	13.	3,571
*Missouri	32,400	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. Cent.	582,800	6.3	36,806	1.3	7,342	3.3	19,642	0.6	3,549	t	225	0.8	4,702	12.7	74,874
*Delaware	33,300	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maryland	173,600	1.	1,940	1.5	2,909	5.	9,698	-	-	0.5	970	1.	1,940	10.5	20,366
Virginia	64,800	1.	820	10.	8,203	4.	3,281	-	-	0	0	2.	1,641	21.	17,226
S. Atl.	271,700	1.	2,760	4.	11,112	4.7	12,979	-	-	0.4	970	1.3	3,581	13.6	37,592
*Kentucky	11,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tenn.	23,200	50.	29,000	2.	1,160	5.	2,900	-	-	-	-	1.	580	60.	34,800
*Arkansas	42,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. Cent.	77,200	-	29,000	-	1,160	-	2,900	-	-	-	-	-	580	-	34,800
Colorado	11,900	t	+	t	+	-	-	-	-	10.	1,322	-	-	10.	1,322
Utah	54,100	-	-	-	-	-	-	-	-	5.	3,381	5.a/	3,381	20.b/	13,525
*Calif.	263,300	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Far West	329,300	t	+	t	+	-	-	-	-	5.8	4,703	4.2	3,381	18.4	14,847
*Others	70,300														
U. S.	1,724,200	5.7	74,502	1.5	19,710	5.1	66,614	0.5	6,542	0.5	6,304	1.2	15,439	15.9	207,502

° Short tons, 2000 pounds. * Omitted in calculations for section and U. S. percentage loss.

a/ Curly top. b/ Verticillium wilt (Verticillium albo-atrum), 10 percent, 6,763 short tons.

Percentage of total listed production in reporting area, 63.

GREEN BEANS

Table 11. Estimated reduction in yield from bacterial blights (Bacterium phaseoli and B. medicaginis phaseolicola), virus diseases, root and stem rots (Fusarium, Rhizoctonia, etc.), rust (Uromyces phaseoli typica), powdery mildew (Erysiphe polygoni), and other diseases, 1938.

State	Production 1000 bu.°	Bacterial blights: Common %	Common 1000 bu.	Halo %	Halo 1000 bu.	Virus diseases a/ %	Virus diseases 1000 bu.	Root rots %	Root rots 1000 bu.	Rust %	Rust 1000 bu.	Powdery mildew %	Powdery mildew 1000 bu.	All diseases %	All diseases 1000 bu.
Maine	333	-	-	t	+	-	-	-	-	-	-	-	-	t	+
Mass.		2.	+	1.	+	0.2	+	-	-	0.1	+	-	-	6.2	+
N. Y.	1,811	1.	20	5.	102	2.	41	2.2	45	0.2	4	0.1	2	11.1	226
*N. J.	1,081	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pa.	743	0.5	4	1.	8	2.	16	2.	16	0.2	2	t	+	6.7	54
Ohio		5.	+			1.	+	1.	+	-	-	-	-	9.	+
*Indiana	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Illinois	108	10.	12	-	-	-	-	-	-	-	-	-	-	10.	12
*Michigan	699	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wis.	813	1.	8	1.	8	1.	8	t	+	t	+	0	0	3.	24
Iowa		4.	+			1.	+	0.1	+	-	-	-	-	8.1	+
*Delaware	103	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maryland	1,580	8.	141			0.5	9	2.	35	t	+	t	+	10.5	185
Virginia	775	1.	12	15.	186	0	0	4.	50	10.	124	7.	87	37.5	465
N. C.	665	1.	7	1.	7	2.	15	2.	15	2.	15	2.	15	11.	81
*S. C.	404	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Georgia	280	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Florida	5,381	3.	188	5.	313	-	-	2.	125	2.	125	1.	63	14	877
Tenn.	287	-	-	-	-	t	+	-	-	1.	3	t	+	1.5	4
*Alabama	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Miss.	412	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Ark.	383	-	-	-	-	-	-	-	-	-	-	-	-	-	-
La.	864	10.	96			-	-	t	+	t	+	-	-	10.	96
Texas	370	-	-	-	-	t	+	-	-	t	+	t	+	t	+
Idaho		t	+	t	+	11.	+	t	+	-	-	-	-	11.	+
Wyoming		3.	+	30.	+	3.	+	-	-	t	+	-	-	36.	+
Colorado	606	6.	39			1.	7	-	-	-	-	-	-	7.	46
*Utah	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wash.	327	0.3	1	0.3	1	6.	21	-	-	0.4	1	-	-	7.	24
*Oregon	913	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Calif.	2,150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Other States	793														
U. S.	22,239	3.2	528	3.7	625	0.7	117	1.7	286	1.6	274	1.0	167	12.5	2,094

a/ All mosaic, except in Idaho, 6 percent, and in Washington, 5 percent, from curly top.

* Omitted in calculations for U. S. percentage loss.

Approximate percentage of total crop in reporting area, 66.

° Bushels of 30 pounds. Production of beans for manufacture given in short tons reduced to thousands of bushels.

DRY BEANS

Table 12. Estimated reduction in yield due to bacterial blights (Bacterium phaseoli and B. medicaginis phaseolicola), virus diseases, root and stem rots (Fusarium, Rhizoctonia, etc.) and other diseases, 1938.

State	Production**	Estimated reduction in yield due to diseases									
		Bacterial blights				Virus diseases a/		Root rots		All diseases	
		Common		Halo							
	1,000 bags°	%	1,000 bags	%	1,000 bags	%	1,000 bags	%	1,000 bags	%	1,000 bags
Maine	101	-	-	-	-	-	-	-	-	t	+
*Vt.	19	-	-	-	-	-	-	-	-	-	-
N. Y.	1,449	1.	16	5.	80	0.5	8	2.2	35	4.3	149
Mich.	4,567	2.	96	1.	48	0.1	5	0.2	10	4.5	216
Wis.	8	1.	+	1.	+	1.	+	t	+	3.	+
*Minn.	14	-	-	-	-	-	-	-	-	-	-
Nebr.	190	9.	55	60.	368	-	-	-	-	69.	423
Okla.		3.	+	-	-	t	+	-	-	4.	+
Mont.	216	2.	5	5.	12	2.	5	1.	2	10.	24
Idaho	1,566	t	+	t	+	4.	65	t	+	4.	65
Wyo.	470	3.	22	30.	220	3.	22	-	-	36.	264
Colo.	1,498	6.	97			1.	16	-	-	7.	113
*N. M.	531	-	-	-	-	-	-	-	-	-	-
*Ariz.	64	-	-	-	-	-	-	-	-	-	-
*Oregon	12	-	-	-	-	-	-	-	-	-	-
*Calif.	4,563	-	-	-	-	-	-	-	-	-	-
U. S.	15,268	2.6	291	6.4	728	1.1	121	0.4	47	11.1	1,254

° Bags of 100 pounds.

a/ All mosaic, except Montana with 2 percent from mosaic, trace from curly top; and Idaho, mosaic and curly top, each 2 percent.

* Omitted from calculations for U. S. percentage loss. Percentage of total listed production in States reporting, 66.

** Includes beans grown for seed.

GREEN PEAS: FOR MANUFACTURE

Table 13. Estimated reduction in yield due to wilt and near wilt (Fusarium spp.), ascochyta blights (Mycosphaerella pinodes and Ascochyta spp.), root and stem rots caused by various organisms, virus diseases, and other diseases, 1938.

State	Production short tons	Estimated reduction in yield due to diseases									
		Wilt and near wilt		Ascochyta blights		Root and stem rots		Virus diseases		All diseases	
		%	Short tons	%	Short tons	%	Short tons	%	Short tons	%	Short tons
*Maine	2,860	-	-	-	-	-	-	-	-	-	-
N. Y.	29,640	0.5	206	0.3	124	15.	6,175	12.	4,940	28.	11,527
Pa.	8,060	0.5	43	t	+	6.	517	t	+	6.5	560
Ohio	3,060	1.	33	1.	33	3.	99	-	-	7.	231
*Ind.	6,180	-	-	-	-	-	-	-	-	-	-
*Ill.	11,140	-	-	-	-	-	-	-	-	-	-
Mich.	11,180	0.1	11	0.1	11	0.1	11	0.1	11	0.5	55
Wis.	98,800	3.	3,153	t	+	3.	3,153	t	+	6.	6,306
*Minn.	18,630	-	-	-	-	-	-	-	-	-	-
*Dela.	1,400	-	-	-	-	-	-	-	-	-	-
Md.	17,770	-	-	0.3	56	4.	744	-	-	4.5	837
*Va.	4,200	-	-	-	-	-	-	-	-	-	-
Mont.	1,990	-	-	t	+	2.1	43	t	+	2.1	43
Colo.	2,950	-	-	-	-	10.	328	-	-	10.	328
*Utah	20,660	-	-	-	-	-	-	-	-	-	-
Wash.	25,760	1.	271	0.5	136	1.	271	1.	271	5.	1,356
*Ore.	17,280	-	-	-	-	-	-	-	-	-	-
*Other States	16,700										
U. S.	298,260	1.7	3,717	0.2	360	5.1	11,341	2.4	5,222	9.7	21,243

* Omitted from calculations for U. S. percentage loss.

Percentage of total listed production in States reporting, 67.

GREEN PEAS: FOR MARKET

Table 14. Estimated reduction in yield due to wilt and near wilt (*Fusarium* spp.), ascochyta blights (*Mycosphaerella pinodes* and *Ascochyta* spp.), root and stem rots caused by various organisms, virus diseases, and other diseases, 1938.

State	Production 1000 °bushels	Estimated reduction in yield due to diseases: Wilt and near wilt		Ascochyta blights		Root and stem rots		Virus diseases		All diseases	
		%	1000 bu.	%	1000 bu.	%	1000 bu.	%	1000 bu.	%	1000 bu.
Mass.		5.	+	0.2	+	8.	+	0.2	+	15.	+
N. Y.	465	0.5	3	0.3	2	15.	97	12.	78	28.	181
*N. J.	185	-	-	-	-	-	-	-	-	-	-
Pa.		0.5	+	t	+	6.	+	t	+	6.5	+
Ohio		1.	+	1.	+	3.	+	-	-	7.	+
Mich.		0.1	+	0.1	+	0.1	+	0.1	+	0.5	+
Wis.		3.	+	t	+	3.	+	t	+	6.	+
Md.	12	-	-	0.3	+	4.	1	-	-	4.5	1
*Va.	195	-	-	-	-	-	-	-	-	-	-
N. C.	225	1.	2	1.	2	4.	10	-	-	9.	21
*S. C.	230	-	-	-	-	-	-	-	-	-	-
Fla.	558	-	-	-	-	5.	30	-	-	6.	36
Tenn.		t	+	t	+	t	+	t	+	t	+
*Ala.	16	-	-	-	-	-	-	-	-	-	-
*Miss.	162	-	-	-	-	-	-	-	-	-	-
*La.	60	-	-	-	-	-	-	-	-	-	-
Okla.		1.	+	-	-	-	-	t	+	7.	+
*Texas	300	-	-	-	-	-	-	-	-	-	-
Mont.		t	+	t	+	2.1	+	t	+	2.1	+
Idaho	520	-	-	-	-	t	+	t	+	t	+
Colo.	1,020	-	-	-	-	10.	113	-	-	10.	113
*Ariz.	63	-	-	-	-	-	-	-	-	-	-
*Utah	232	-	-	-	-	-	-	-	-	-	-
Wash.	546	1.	6	0.5	3	1.	6	1.	6	5.	30
*Ore.	52	-	-	-	-	-	-	-	-	-	-
*Calif.	3,440	-	-	-	-	-	-	-	-	-	-
U.S.	8,281	0.3	11	0.2	7	6.9	257	2.3	84	10.3	382

° Bushels of 30 pounds.

* Omitted in calculations for U. S. percentage loss.

Percentage of total listed production in States reporting, 40.

SUGAR BEET

Table 15. Estimated reduction in yield due to curly top (virus), leaf spot (*Cercospora beticola*), root rots (various organisms), damping-off (various organisms), and other diseases, 1938.

State	Production: 1000 short tons	Curly top: %	Curly top: 1000 tons	Leaf spot: %	Leaf spot: 1000 tons	Root rots: %	Root rots: 1000 tons	Damping-off: %	Damping-off: 1000 tons	All diseases: %	All diseases: 1000 tons
Ohio	397	0	0	8.	35	0.5	2	-	-	8.5	37
Mich.	1,028	0	0	15.5	191	1.	12	-	-	16.7	205
Wis.		0	0	3.	+	3.	+	1.	+	7.	+
Iowa		0	0	10.	+	16.5	+	5.	+	32.2	+
*Nebr.	1,081	0	0	-	-	-	-	-	-	-	-
Texas		t	+	t	+	t	+	-	-	1.	+
Mont.	955	6.	69	t	+	5.	58	3.	35	17.	197
Idaho	1,019	t	+	-	-	t	+	t	+	t	+
Wyo.	687	-	-	t	+	-	-	-	-	t	+
Colo.	1,984	t	+	t	+	t	+	-	-	t	+
*Utah	742	-	-	-	-	-	-	-	-	-	-
Wash.		5.	+	-	-	0.6	+	0.4	+	6.	+
*Calif.	1,993	-	-	-	-	-	-	-	-	-	-
*Other States	1,406										
U. S.	11,292	1.1	69	3.5	226	1.1	72	0.5	35	6.7	439

* Omitted from calculations for U. S. percentage loss.
Percentage of total listed production in States reporting, 54.

Table 16. Estimated reduction in yield due to anthracnose (Glomerella gossypii), angular leaf spot (Bacterium malvacearum), fusarium wilt (Fusarium vasinfectum), root knot (Heterodera marioni), cotton root rot (Phymatotrichum omnivorum), seedling blights (various organisms), deficiency diseases, and other diseases, 1938.

State	Production	Anthracnose		Angular leaf spot		Wilt		Root knot		Root rot		Seedling blights		Deficiency diseases		All diseases	
	1,000 bales°	%	1,000 bales	%	1,000 bales	%	1,000 bales	%	1,000 bales	%	1,000 bales	%	1,000 bales	%	1,000 bales	%	1,000 bales
*Mo.	337	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-
Va.	15	15.	3	2.	+	-	-	-	-	0	0	5.	1	2.	+	24.	5
N. C.	400	3.	20	2.	13	7.	47	3.	20	0	0	15.	101	10.	67	40.5	271
*S. C.	650	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-
Georgia	857	0.1	1	2.	23	5.	56	2.	23	0	0	10.	113	5.	56	24.1	272
*Florida	25	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-
Tenn.	487	1.	5	2.	10	3.	16	t	+	0	0	-	-	t	+	6.	31
*Ala.	1,080	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-
*Miss.	1,715	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-
Ark.	1,340	t	+	t	+	5.	74	1.	15	t	+	1.	15	2.	29	9.	133
La.	676	3.	25	1.	8	5.	42	0.5	4	0	0	2.	17	5.	42	19.5	163
Okla.	570	-	-	5.	35	1.	7	1.	7	3.	21	3.	21	5.	35	18.	126
Texas	3,125	-	-	t	+	t	+	t	+	7.6	260	0.5	17	0.7	24	8.8	301
*N. Mex.	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Ariz.	196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Calif.	423	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
All others	17																
U. S.	12,008	0.6	54	1.	89	2.8	242	0.8	69	3.2	281	3.2	285	2.9	253	14.8	1,302

Approximate percentage of total listed production represented in reporting area, 62.

° Bales of 500 pounds.

* Omitted from calculations for U. S. percentage loss.

Table 17. Estimated reduction in yield due to downy mildew (Peronospora tabacina), black root rot (Thielaviopsis basicola), mosaic (virus), bacterial leaf spots (Bacterium tabacum and angulatum), deficiency diseases, and other diseases, 1938.

State	Production	Downy mildew		Black root rot		Mosaic		Bacterial leaf spots		Deficiency diseases		All diseases	
	1,000 pounds	%	1,000 pounds	%	1,000 pounds	%	1,000 pounds	%	1,000 pounds	%	1,000 pounds	%	1,000 pounds
Mass.	6,702	0.5	39	1.	77	7.	542	5.	387	t	+	13.5	1,045
*Conn.	16,726	-	-	-	-	-	-	-	-	-	-	-	-
*N. Y.	1,620	-	-	-	-	-	-	-	-	-	-	-	-
Pa.	32,690	t	+	t	+	1.	380	13.	4,942	-	-	14.	5,322
Ohio	24,617	6.	1,660	t	+	-	-	4.	1,106	1.	277	11.	3,043
*Ind.	10,350	-	-	-	-	-	-	-	-	-	-	-	-
Wis.	36,759	0	0	1.	379	t	+	t	+	t	+	3.	1,137
*Minn.	770	0	0	-	-	-	-	-	-	-	-	-	-
*Mo.	7,035	-	-	-	-	-	-	-	-	-	-	-	-
*Kans.	525	0	0	-	-	-	-	-	-	-	-	-	-
Md.	29,250	12.	5,014	0.5	209	6.	2,507	7.	2,925	1.5	627	30.	12,536
Va.	105,459	10.	15,740	t	+	3.	4,722	t	+	2.	3,148	33.	51,942
*W. Va.	3,190	-	-	-	-	-	-	-	-	-	-	-	-
N. C.	519,230	1.	6,970	1.	6,970	3.	20,909	2.	13,939	3.	20,909	25.5 a/	177,725
*S. C.	98,430	-	-	-	-	-	-	-	-	-	-	-	-
Ga.	91,820	t	+	-	-	0	-	0	-	t	+	5.8 b/	5,653
*Florida	19,392	-	-	-	-	-	-	-	-	-	-	-	-
Ky.	339,550	t	+	1.	4,298	3.	12,894	16.	68,770	1.	4,298	21.	90,260
Tenn.	111,855	t	+	2.	2,745	2.	2,745	14.	19,214	-	-	18.5	25,390
U. S.	1,455,970	1.8	29,423	0.9	14,678	2.7	44,699	6.7	111,283	1.7	29,259	22.5	374,053

Approximate percentage of total crop represented in reporting area, 89.

a/ Rootknot, 8 percent; 55,756,000 pounds. b/ Rootknot, 4 percent; 3,899,000 pounds.

* Omitted in calculations for U. S. percentage loss.

PEAR

Table 18. Estimated reduction in yield due to blight (*Bacillus amylovorus*), scab (*Venturia pyrina*), leaf blight (*Fabraea maculata*), and other diseases, 1938.

State	Production: 1000 bu.	Estimated reduction in yield due to diseases: Blight %	Blight 1000 bu.	Scab %	Scab 1000 bu.	Leaf blight %	Leaf blight 1000 bu.	All diseases %	All diseases 1000 bu.
*Maine	13	-	-	-	-	-	-	-	-
*N. H.	15	-	-	-	-	-	-	-	-
*Vermont	7	-	-	-	-	-	-	-	-
Mass.	75	0.1	1	0.1	1	0.1	1	11.	12
*R. I.	11	-	-	-	-	-	-	-	-
*Conn.	49	-	-	-	-	-	-	-	-
N. Y.	1,924	t	+	t	+	t	+	1.	19
*N. J.	57	-	-	-	-	-	-	-	-
Pa.	657	15.	117	0.5	4	t	+	15.5	121
N. Atl.	2,808	-	118	-	5	-	1	-	152
Ohio	634	6.	41	1.	7	-	-	7.	48
Ind.	366	20.	92	-	-	-	-	20.	92
Ill.	429	t	+	-	-	5.	23	5.	23
Mich.	1,360	5.	72	t	+	t	+	5.	72
Wis.		1.5	+	10.	+	t	+	11.5	+
Iowa	104	3.	3	0	0	-	-	3.	3
*Missouri	66	-	-	-	-	-	-	-	-
*Nebraska	54	-	-	-	-	-	-	-	-
*Kansas	58	-	-	-	-	-	-	-	-
N. Cent.	3,071	6.6	208	0.2	7	0.7	23	7.6	238
*Delaware	7	-	-	-	-	-	-	-	-
Maryland	82	10.	10	2.5	2	3.	3	15.5	15
Virginia	334	1.	3	t	+	t	+	2.	6
*W. Va.	35	-	-	-	-	-	-	-	-
N. C.	364	10.	50	t	+	15.	75	27.	135
*S. C.	129	-	-	-	-	-	-	-	-
Georgia	404	50.	404	-	-	-	-	50.	404
*Florida	156	-	-	-	-	-	-	-	-
S. Atl.	1,511	26.8	467	0.1	2	4.5	78	32.1	560
*Kentucky	135	-	-	-	-	-	-	-	-
Tennessee	186	30.	80	-	-	-	-	30.	80
*Alabama	383	-	-	-	-	-	-	-	-
*Miss.	462	-	-	-	-	-	-	-	-
*Arkansas	156	-	-	-	-	-	-	-	-
*Louisiana	190	-	-	-	-	-	-	-	-
Okla.	80	3.	2	-	-	1.	1	4.	3
Texas	440	t	+	-	-	-	-	t	+
S.Central	2,032	-	82	-	-	-	1	-	83
Idaho	67	12.	10	0	0	0	0	20.	17
Colorado	251	10.	28	-	-	-	-	10.	28
*N. Mex.	27	-	-	-	-	-	-	-	-
*Arizona	6	-	-	-	-	-	-	-	-
*Utah	127	-	-	-	-	-	-	-	-
*Nevada	4	-	-	-	-	-	-	-	-
Wash.	6,278	0.5	32	0.5	32	-	-	2.	128
*Oregon	4,326	-	-	-	-	-	-	-	-
*Calif.	11,751	-	-	-	-	-	-	-	-
Far West.	22,837	-	70	-	32	-	-	-	173
U. S.	32,259	6.2	945	0.3	46	0.2	103	8.1	1,206

Approximate percentage of total crop in reporting area, 44.

* Omitted from calculations for U. S. and section percentage loss.

CHERRY

Table 19. Estimated reduction in yield due to brown rot (Sclerotinia fructicola), leaf spot (Coccomyces hiemalis), virus diseases, and other diseases, 1938.

State	Production tons	Brown rot %	Brown rot Tons	Leaf spot %	Leaf spot Tons	Virus diseases %	Virus diseases Tons	All diseases %	All diseases Tons
		Estimated reduction in yield due to diseases							
Massachusetts		8.	+	1.	+	t	+	11.	+
New York	16,360	1.	167	1.	167	-	-	2.	334
Pennsylvania	6,560	5.	377	8.	604	0.1	8	13.1	989
Ohio	3,630	t	+	8.	316	-	-	8.	316
Indiana		3.	+	3.	+	-	-	6.	+
Illinois		-	-	2.	+	-	-	2.	+
Michigan	14,940	t	+	20.	3,831	0	0	22.	4,214
Wisconsin	9,440	t	+	10.	1,049	0	0	10.	1,049
Iowa		5.	+	0.1	+	-	-	5.1	+
Maryland		3.	+	5.	+	-	-	8.	+
Virginia		10.	+	10.	+	-	-	20.	+
West Virginia		0.5	+	5.	+	-	-	6.	+
N. C.		5.	+	3.	+	-	-	8.	+
Arkansas		t	+	1.	+	-	-	1.	+
Oklahoma		2.	+	3.	+	-	-	8.	+
Montana	470	0	0	t	+	-	-	t	+
Idaho	2,490	0	0	0	0	1.	26	4.	104
Colorado	5,280	-	-	-	-	-	-	1.	53
*Utah	4,270	-	-	-	-	-	-	-	-
Washington	25,500	0.3	78	0.3	78	0.6	156	2.	520
*Oregon	21,400	-	-	-	-	-	-	-	-
*California	28,800	-	-	-	-	-	-	-	-
Twelve States	139,140	0.7	622	6.6	6,045	0.2	190	8.3	7,579

Percentage of total listed production in States reporting, 73.

* Omitted from calculations for U. S. percentage loss.

Table 20. Estimated reduction in yield from bitter rot (Glomerella cingulata), black rot (Physalospora cydoniae), blotch (Phyllosticta solitaria), rusts (Gymnosporangium spp.), fire blight (Bacillus amylovorus), scab (Venturia inaequalis), and other diseases, 1938.

State	Production 1,000 bushels	Bitter rot %	Bitter rot 1,000 bu.	Black rot %	Black rot 1,000 bu.	Blotch %	Blotch 1,000 bu.	Rusts %	Rusts 1,000 bu.	Blight %	Blight 1,000 bu.	Scab %	Scab 1,000 bu.	All diseases %	All diseases 1,000 bu.
Maine	858	0	0	-	-	0	0	t	+	-	-	2.	18	2.	18
*N. H.	623	0	0	-	-	0	0	-	-	-	-	-	-	-	-
Vermont	475	0	0	-	-	0	0	t	+	t	+	3.	15	4.5	22
Mass.	2,524	0.5	16	1.	32	0	0	0.3	10	0.1	3	12.	388	22.	711
*R. I.	308	-	-	-	-	0	0	-	-	-	-	-	-	-	-
Connecticut	1,659	-	-	-	-	0	0	-	-	-	-	5.	87	5.	87
New York	16,380	-	-	0.1	17	0.1	17	0.3	51	0.1	17	2.	338	3.	508
*New Jersey	4,067	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pa.	9,338	0.2	23	2.	235	0.2	23	0.5	59	2.5	293	12.	1,408	20.4	2,393
N. Atlantic	36,232	0.1	39	0.8	284	0.1	40	0.3	120	0.9	313	6.4	2,254	10.6	3,739
Ohio	3,565	0.5	21	0.1	4	0.2	8	1.	42	2.	85	12.	508	15.8	668
Indiana	1,410	t	+	t	+	0.1	2	t	+	1.	16	8.	124	9.1	142
Illinois	2,912	t	+	3.	97	1.	32	-	-	t	+	6.	194	10.	323
Michigan	7,095	t	+	t	+	t	+	t	+	1.	84	10.	845	16.	1,351
Wisconsin	1,107	0	0	t	+	t	+	1.	15	1.	15	25.	379	27.	409
Minnesota	694	0	0	0	0	0	0	1.	11	2.	22	25.	280	38.	425
Iowa	1,305	0.1	2	0.5	8	0.1	2	1.	15	5.	76	7.5	114	14.4	220
*Missouri	588	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*S. Dak.	101	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Nebraska	753	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Kansas	742	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. Central	20,272	0.1	23	0.5	109	0.2	44	0.4	83	1.4	298	11.3	2,444	16.4	3,538
*Delaware	1,771	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maryland	2,118	-	-	0.5	11	-	-	0.2	4	1.5	33	2.	44	4.2	92
Virginia	10,080	1.5	171	t	+	t	+	1.7	194	0.3	34	4.	457	11.8	1,347
W. Va.	4,800	0.1	5	0.1	5	0.1	5	0.4	20	0.5	26	4.	264	6.	306
N. C.	1,961	1.	25	0.5	13	2.	51	1.	25	8.	202	5.	127	22.5	570
*S. C.	245	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Georgia	964	5.	55	-	-	-	-	1.	11	2.	22	5.	55	13.	143
S. Atlantic	21,939	1.1	256	0.1	29	0.3	56	1.1	254	1.4	317	4.	887	11.	2,458

Apple (Continued).

Apple (Continued).

State	Production 1,000 bushels	Bitter rot %	Bitter rot 1,000 bu.	Black rot %	Black rot 1,000 bu.	Blotch %	Blotch 1,000 bu.	Rusts %	Rusts 1,000 bu.	Blight %	Blight 1,000 bu.	Scab %	Scab 1,000 bu.	All diseases %	All diseases 1,000 bu.
		Estimated reduction in yield due to diseases													
*Kentucky	801	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tennessee	654	5.	36	0.1	1	0.1	1	t	+	1.	7	2.	14	8.2	59
*Alabama	672	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Mississippi	192	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Arkansas	364	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Louisiana	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oklahoma	234	1.	3	1.	3	4.	10	1.	3	1.	3	1.	3	9.	25
*Texas	91	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. Central	3,025	-	39	-	4	-	11	-	3	-	10	-	17	-	84
Montana	540	0	0	0	0	0	0	0	0	3.	17	t	+	3.	17
Idaho	3,953	0	0	0	0	0	0	0	0	t	+	t	+	1.	40
Wyoming	42	0	0	0	0	0	0	0	0	5.	2	-	-	5.	2
Colorado	1,982	0	0	0	0	0	0	-	-	-	-	t	+	t	+
*New Mexico	547	0	0	0	0	0	0	-	-	-	-	-	-	-	-
*Arizona	83	0	0	0	0	0	0	-	-	-	-	-	-	-	-
*Utah	544	0	0	0	0	0	0	-	-	-	-	-	-	-	-
*Nevada	46	0	0	0	0	0	0	-	-	-	-	-	-	-	-
Washington	31,100	0	0	-	-	0	0	-	-	0.2	66	0.2	66	6.	1,985
*Oregon	4,142	0	0	-	-	0	0	-	-	-	-	-	-	-	-
*California	7,435	0	0	-	-	0	0	-	-	-	-	-	-	-	-
Far Western	50,414	0	0	-	-	0	0	-	-	-	85	-	66	-	2,044
U. S.	131,882	0.3	357	0.4	426	0.1	151	0.4	460	0.9	1,023	4.7	5,668	10.	11,863

Percentage of total listed production in States reporting, 82.

* Omitted from calculations for U. S. and section percentage loss.

PEACH

Table 21. Estimated reduction in yield from leaf curl (*Taphrina deformans*), brown rot (*Sclerotinia fructicola*), scab (*Cladosporium carpophilum*), bacterial spot (*Bacterium pruni*), virus diseases, and other diseases, 1938.

State	Production: 1000 bu.	Leaf curl: %	Leaf curl: 1000 bu.	Brown rot: %	Brown rot: 1000 bu.	Scab: %	Scab: 1000 bu.	Bacterial spot: %	Bacterial spot: 1000 bu.	Virus diseases: %	Virus diseases: 1000 bu.	All diseases: %	All diseases: 1000 bu.
*N.H.	19	-	-	-	-	-	-	-	-	-	-	-	-
Mass.	88	1.	1	2.	2	1.5	1	0.1	+	2.2	2	7.	6
*R.I.	27	-	-	-	-	-	-	-	-	-	-	-	-
Conn.	140	-	-	10.	18	-	-	10.	18	2.	4	22.	40
N.Y.	1,134	1.	12	1.	12	t	+	t	+	t	+	2.	24
*N.J.	1,172	-	-	-	-	-	-	-	-	-	-	-	-
Pa.	1,842	1.5	33	10.	218	3.	65	t	+	0.1	2	15.6	340
Ohio	481	1.	5	5.	26	2.	11	0.5	3	t	+	8.5	45
Ind.	144	t	+	0.5	1	t	+	0.2	+	-	-	0.7	1
Ill.	1,425	t	+	5.	86	2.	34	10.	172	-	-	17.	292
Mich.	1,341	t	+	10.	156	t	+	2.	31	t	+	4.	218
Iowa	90	5.	5	3.	3	0	0	0.1	1	-	-	8.1	9
*Mo.	116	-	-	-	-	-	-	-	-	-	-	-	-
*Nebr.	72	-	-	-	-	-	-	-	-	-	-	-	-
*Kans.	43	-	-	-	-	-	-	-	-	-	-	-	-
*Dela.	304	-	-	-	-	-	-	-	-	-	-	-	-
Md.	352	3.	11	0.5	2	-	-	0.5	2	0.5	2	4.5	17
Va.	1,161	1.	12	4.	50	t	+	t	+	t	+	7.	87
W.Va.	184	0.5	1	2.	4	0.5	1	-	-	-	-	3.5	7
N.C.	2,232	0.5	13	8.	206	1.	26	1.	26	-	-	13.5	348
*S.C.	1,515	-	-	-	-	-	-	-	-	-	-	-	-
Ga.	5,320	1.	68	5.	341	1.	68	10.	682	5.	341	22.	1,500
*Fla.	68	-	-	-	-	-	-	-	-	-	-	-	-
*Ky.	352	-	-	-	-	-	-	-	-	-	-	-	-
Tenn.	586	0.5	4	20.	147	0	0	-	-	-	-	20.5	151
*Ala.	1,705	-	-	-	-	-	-	-	-	-	-	-	-
*Miss.	1,061	-	-	-	-	-	-	-	-	-	-	-	-
*Ark.	2,451	-	-	-	-	-	-	-	-	-	-	-	-
*La.	325	-	-	-	-	-	-	-	-	-	-	-	-
Okla.	429	3.5	17	3.	15	1.	5	4.	19	t	+	11.5	56
Texas	964	t	+	-	-	t	+	t	+	-	-	0.5	5
Idaho	181	t	+	0	0	-	-	0	0	-	-	11.	22
Colo.	1,388	-	-	-	-	-	-	0	0	1.	14	2.	28
*N.M.	51	-	-	-	-	-	-	0	0	-	-	-	-
*Ariz.	22	-	-	-	-	-	-	0	0	-	-	-	-
*Utah	564	-	-	-	-	-	-	0	0	-	-	-	-
*Nev.	6	-	-	-	-	-	-	0	0	-	-	-	-
Wash.	1,428	0.3	4	0.3	4	-	-	0	0	-	-	1.	14
*Ore.	327	-	-	-	-	-	-	0	0	-	-	-	-
*Calif.	20,835	-	-	-	-	-	-	0	0	-	-	-	-
U.S.	51,945	0.8	186	5.4	1,291	0.9	211	4.0	954	1.5	365	13.4	3,210

Percentage of total listed production in States reporting, 46.
* Omitted from calculations for U. S. percentage loss.

Table 22. Estimated reduction in yield due to leaf spot (*Mycosphaerella fragariae*), leaf scorch (*Diplocarpon earliana*), root diseases, fruit rots (various organisms), and other diseases, 1938.

State	Production 1,000 crates	Leaf spot %	Leaf spot 1,000 crates	Leaf scorch %	Leaf scorch 1,000 crates	Root diseases[a] %	Root diseases[a] 1,000 crates	Fruit rots %	Fruit rots 1,000 crates	All diseases %	All diseases 1,000 crates
Vt.		5.	+	-	-	-	-	-	-	5.	+
Mass.		2.	+	-	-	-	-	12.	+	15.[b]	+
Conn.		-	-	-	-	-	-	5.	+	5.	+
N. Y.	312	t	+	t	+	-	-	1.	3	1.	3
*N. J.	340	-	-	-	-	-	-	-	-	-	-
Pa.	350	0.9	4	0.3	1	10.	40	0.5	2	11.7	47
Ohio	338	0.5	2	-	-	-	-	t	+	2.[b]	7
Ind.	248	t	+	t	+	t	+	1.	3	1.	3
*Ill.	310	-	-	-	-	-	-	-	-	-	-
Mich.	464	t	+	t	+	10.	52	-	-	10.	52
Wis.	200	0.5	1	1.	2	5.	11	-	-	6.5	14
Minn.		3.	+	-	-	4.	+	-	-	7.	+
Iowa	48	3.	2	-	-	-	-	-	-	3.1	2
*Mo.	540	-	-	-	-	-	-	-	-	-	-
N. Dak.		t	+	-	-	-	-	-	-	2.	+
*Kans.	55	-	-	-	-	-	-	-	-	-	-
*Dela.	234	-	-	-	-	-	-	-	-	-	-
Md.	446	2.	10	1.	5	3.	15	3.	15	10.	50
Va.	511	5.	29	2.	12	5.	29	-	-	12.	70
N. C.	374	15.	81	7.	38	-	-	4.	22	31.	168
*S. C.	15	-	-	-	-	-	-	-	-	-	-
*Ga.	24	-	-	-	-	-	-	-	-	-	-
*Fla.	525	-	-	-	-	-	-	-	-	-	-
*Ky.	424	-	-	-	-	-	-	-	-	-	-
Tenn.	702	1.	8	t	+	2.	16	10.	81	13.	105
*Ala.	244	-	-	-	-	-	-	-	-	-	-
*Miss.	22	-	-	-	-	-	-	-	-	-	-
Ark.	846	t	+	1.	9	-	-	t	+	4.	35
La.	1,100	10.	139	3.	42	-	-	8.	112	21.1	294
Okla.	24	3.	1	1.	+	t	+	-	-	7.	2
*Texas	117	-	-	-	-	-	-	-	-	-	-
Mont.		t	+	-	-	3.	+	-	-	8.[b]	+
Idaho		t	+	t	+	-	-	1.	+	11.	+
Colo.		-	-	-	-	50.	+	-	-	50.	+
*Utah	84	-	-	-	-	-	-	-	-	-	-
Wash.	601	0.5	3	-	-	5.	33	0.5	3	9.[b]	59
*Oreg.	1,139	-	-	-	-	-	-	-	-	-	-
*Calif.	832	-	-	-	-	-	-	-	-	-	-
U. S.	11,469	3.7	280	1.5	109	2.6	196	3.2	241	12.1	911

Percentage of total listed production in States reporting, 56.

* Omitted from calculations for U. S. percentage loss.

a/All black root rot, except Indiana, all red stele (*Phytophthora* sp.); Maryland, trace for red stele; Oklahoma, red stele and black root rot, each trace; Colorado, 50 percent loss from both diseases.

b/Virus diseases: Massachusetts, 1 percent; Ohio, 1.5 percent, 5000 crates; Montana, 5 percent; Washington, 3 percent, 20,000 crates; U. S., 0.3 percent.

GRAPE

Table 23. Estimated reduction in yield from black rot (Guignardia bidwellii), powdery mildew (Uncinula necator), downy mildew (Plasmopara viticola), and other diseases, 1938.

State	Production tons	Estimated reduction in yield due to diseases							
		Black rot		Powdery mildew		Downy mildew		All diseases	
		%	Tons	%	Tons	%	Tons	%	Tons
*Maine	30	-	-	-	-	-	-	-	-
*N. H.	70	-	-	-	-	-	-	-	-
*Vermont	40	-	-	-	-	-	-	-	-
Mass.	540	5.	30	t	+	1.5	9	8.5	51
*R. I.	220	-	-	-	-	-	-	-	-
Connecticut	1,960	15.	346	-	-	-	-	15.	346
New York	55,600	2.	1,158	1.	579	1.	579	4.	2,316
*New Jersey	2,800	-	-	-	-	-	-	-	-
Pa.	15,700	10.	1,744	t	+	t	+	10.	1,744
N. Atlantic	76,960	4.2	3,278	0.7	579	0.8	588	5.7	4,457
Ohio	9,800	3.5	357	-	-	0.5	51	4.	408
Indiana	2,200	10.	244	t	+	-	-	10.	244
*Illinois	6,300	-	-	-	-	-	-	-	-
Michigan	16,900	0.1	17	0.1	17	0.1	17	0.3	51
Wisconsin	430	5.	23	t	+	t	+	5.	23
Minnesota	270	-	-	-	-	t	+	t	+
Iowa	5,000	0.1	5	0.1	5	1.	51	1.3	66
*Missouri	6,200	-	-	-	-	-	-	-	-
*Nebraska	3,100	-	-	-	-	-	-	-	-
*Kansas	3,100	-	-	-	-	-	-	-	-
N. Central	53,300	1.8	646	t	22	0.3	119	2.2	792
*Delaware	1,500	-	-	-	-	-	-	-	-
Maryland	580	15.	107	1.	7	3.	21	19.	135
Virginia	2,000	20.	526	-	-	4.	105	24.	631
*W. Va.	430	-	-	-	-	-	-	-	-
N. C.	6,600	17.	1,486	2.	175	-	-	24.5	2,142
*S. C.	1,670	-	-	-	-	-	-	-	-
*Georgia	1,660	-	-	-	-	-	-	-	-
Florida	820	5.	46	-	-	-	-	10.	92
S. Atlantic	15,260	16.7	2,165	1.4	182	1.	126	23.1	3,000
*Kentucky	2,390	-	-	-	-	-	-	-	-
Tennessee	1,590	25.	530	t	+	t	+	25.	530
*Alabama	1,400	-	-	-	-	-	-	-	-
*Mississippi	250	-	-	-	-	-	-	-	-
Arkansas	4,800	t	+	-	-	-	-	t	+
*Louisiana	50	-	-	-	-	-	-	-	-
Oklahoma	2,500	7.	188	-	-	-	-	7.	188
Texas	2,000	t	+	-	-	-	-	t	+
S. Central	14,980	6.2	718	-	+	-	+	6.2	718
Idaho	580	0	0	t	+	0	0	5.	31
*Colorado	650	-	-	-	-	-	-	-	-
*New Mexico	1,240	-	-	-	-	-	-	-	-
*Arizona	730	-	-	-	-	-	-	-	-
*Utah	860	-	-	-	-	-	-	-	-
*Nevada	100	-	-	-	-	-	-	-	-
Washington	5,200	0	0	0.3	16	0	0	1.	53
*Oregon	2,400	-	-	-	-	-	-	-	-
*California	2,331,000	-	-	-	-	-	-	-	-
Far Western	2,342,760	-	-	-	-	-	-	-	-
U. S.	2,503,260	4.7	6,807	0.6	799	0.6	833	6.3	9,051

Percentage of total listed production in States reporting: for whole country, 5; outside of Far West, 80.

* Omitted from calculations for U. S. and section percentage loss.

DISEASES OF PLANTS IN THE UNITED STATES IN 1938

Compiled by

Nellie W. Nance, Junior Pathologist,
Division of Mycology and Disease Survey.

Plant Disease Reporter
Supplement 119

December 31, 1939.

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INTRODUCTION

Weather conditions are so important in the incidence of plant diseases that it seems desirable to accompany this summary with a brief review. The outstanding feature of the weather of 1938 was its abnormal warmth. The Weather Bureau reports show that for the country as a whole 1938 was one of the warmest years of record and was unique in that every first-order Weather Bureau Station reported above-normal temperature for the year. The greatest abnormalities in temperature occurred in the interior of the country, where in a large area the annual mean was 4° above normal (Figs. 1 to 8). Most States had above-normal rainfall in 1938. The South Atlantic and Gulf areas and Northern Great Plains were relatively dry. The first half of the year was unusually wet, but the last half brought harmful deficiencies in moisture to some midwestern sections, especially the normally drier areas of the Great Plains. The six stations for which detailed records are given were selected some years ago by J. B. Kincer, Principal Meteorologist of the Weather Bureau, as being fairly representative of the various sections (Figs. 9 to 20).

During the year occurred the most severe and widespread epidemic of potato late blight that had been experienced for many years--in some cases, according to reports, for twenty years. A destructive outbreak of psyllid yellows of potato was accompanied by a considerable eastward extension from previous known occurrences. Leaf rust of wheat was epidemic in the Central States, where losses in some cases exceeded any previously recorded. The Northwestern apple tree anthracnose was discovered to be causing severe damage in Maine orchards--the first known occurrence of its presence in the East. Persimmon wilt was found widely scattered throughout the Southeast. Among other important diseases for which extensions of the known range were reported are bacterial ring rot of potato, the Dutch elm disease, and the yellow-red virosis of peach and chokecherry. Pink rot and wilt of potato caused by _Phytophthora_ spp., including _P. erythroseptica_, was reported from Maine, the first record of its occurrence in this country.

This summary follows closely in both form and arrangement the plan of other summaries for many years. The value of these summaries is to a large extent cumulative, since a comparison of different years is an important point of interest.

The Survey wishes to thank all those whose reports and criticisms have made this summary possible.

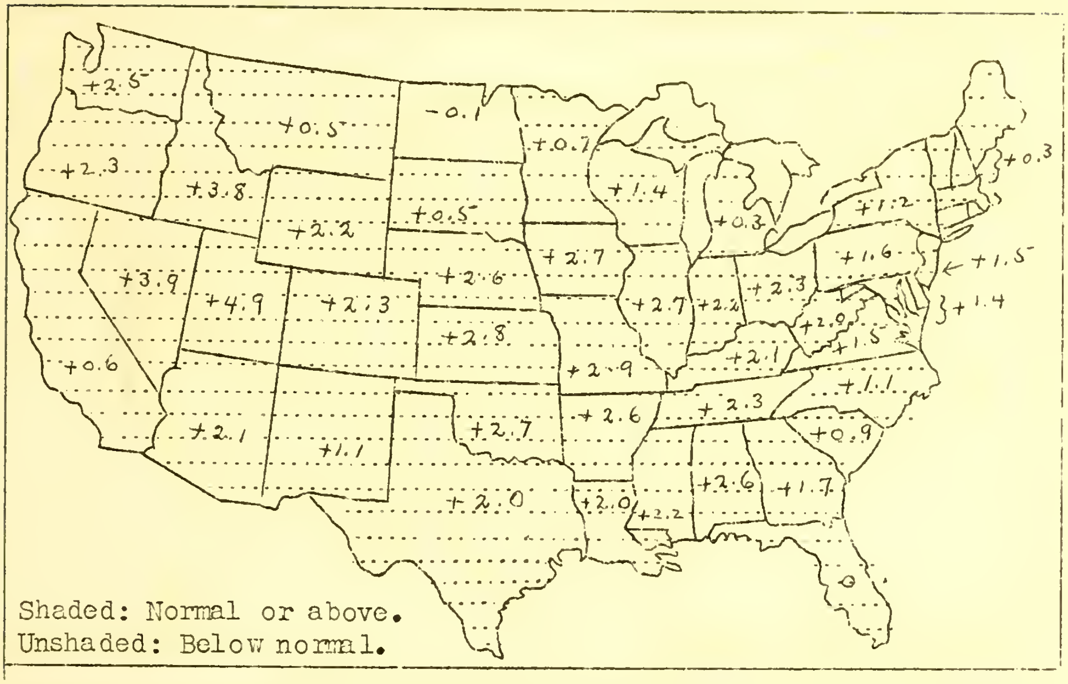

Fig. 1. Departure from the normal temperature for the winter, December 1937 to February 1938, inclusive.

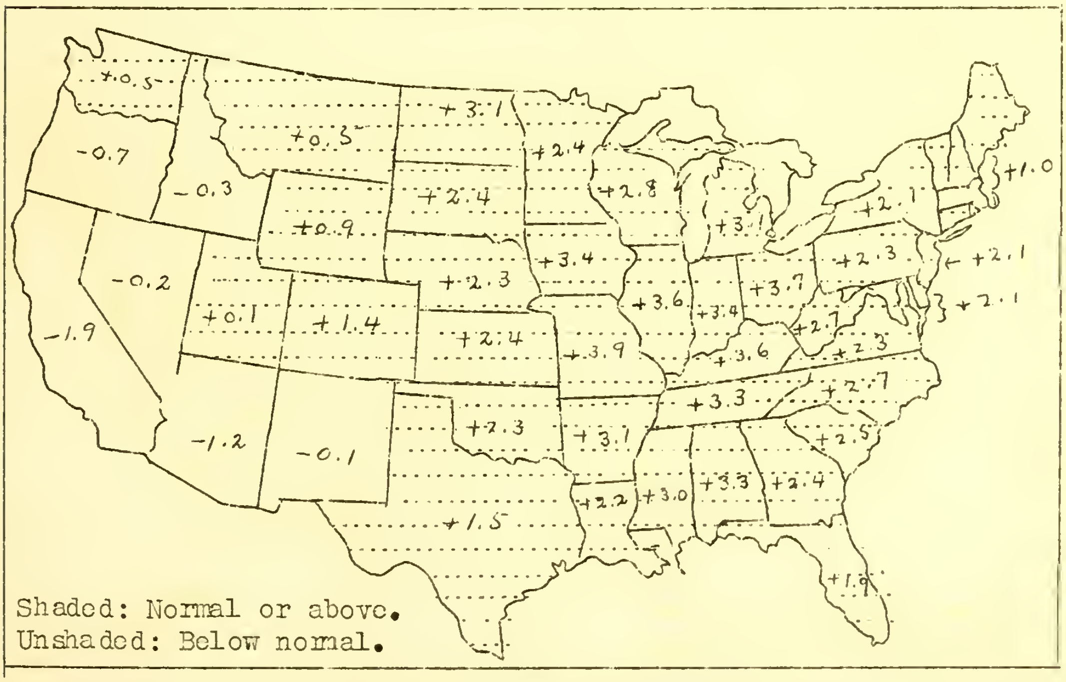

Fig. 2. Departure from the normal temperature for the spring, 1938, March to May, inclusive.

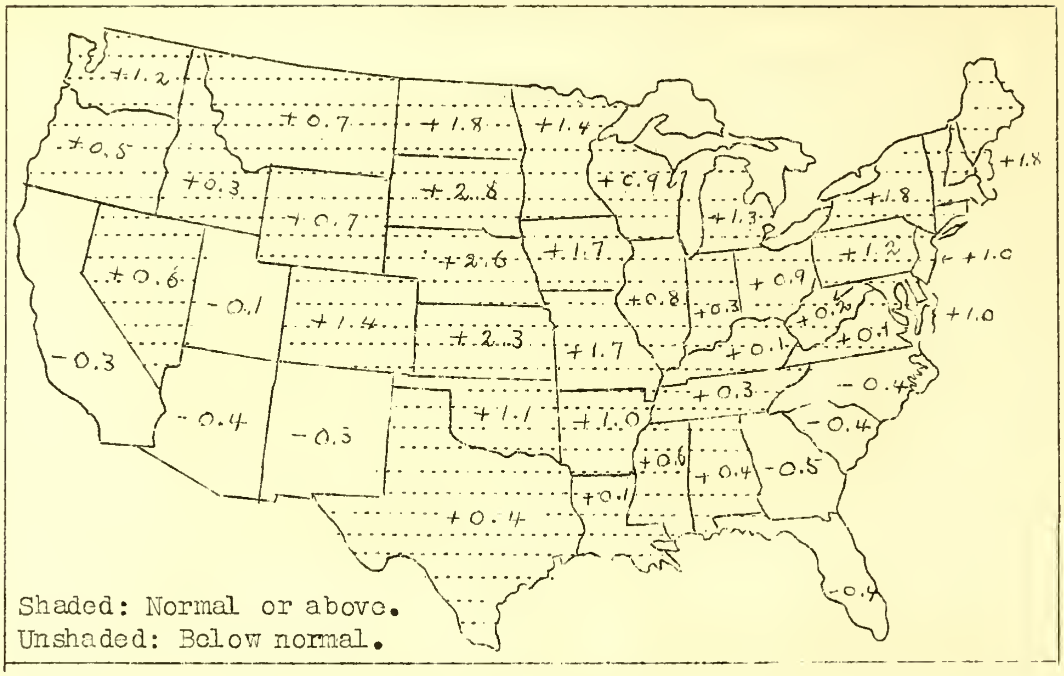

Fig. 3. Departure from the normal temperature for the summer, 1938, June to August, inclusive.

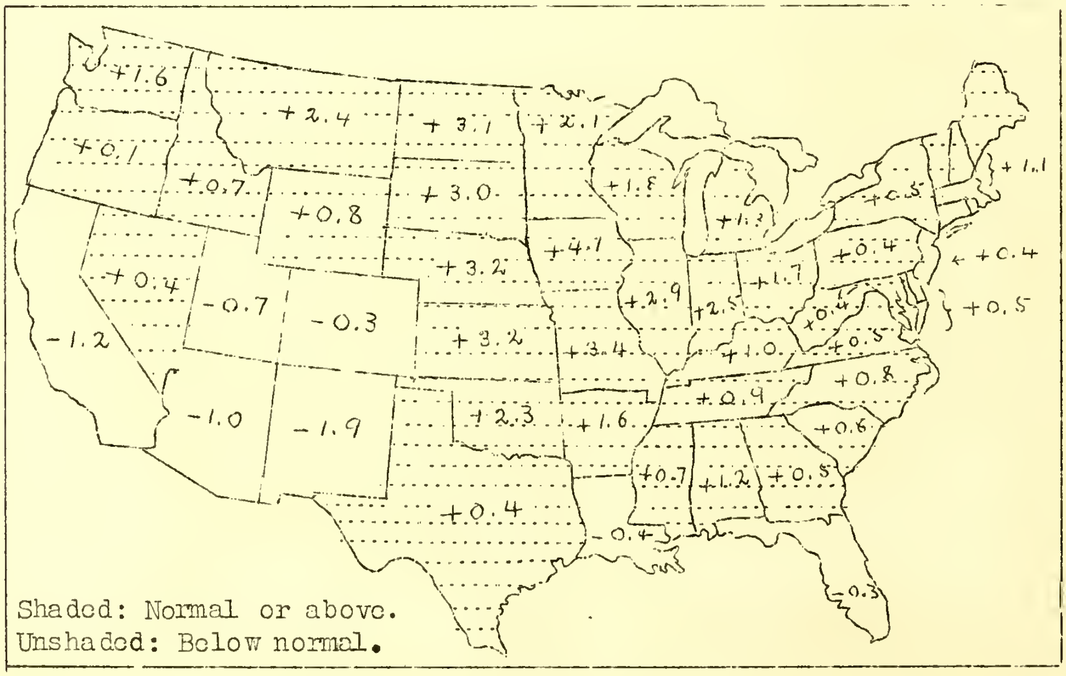

Fig. 4. Departure from the normal temperature for the autumn of 1938, September to November, inclusive.

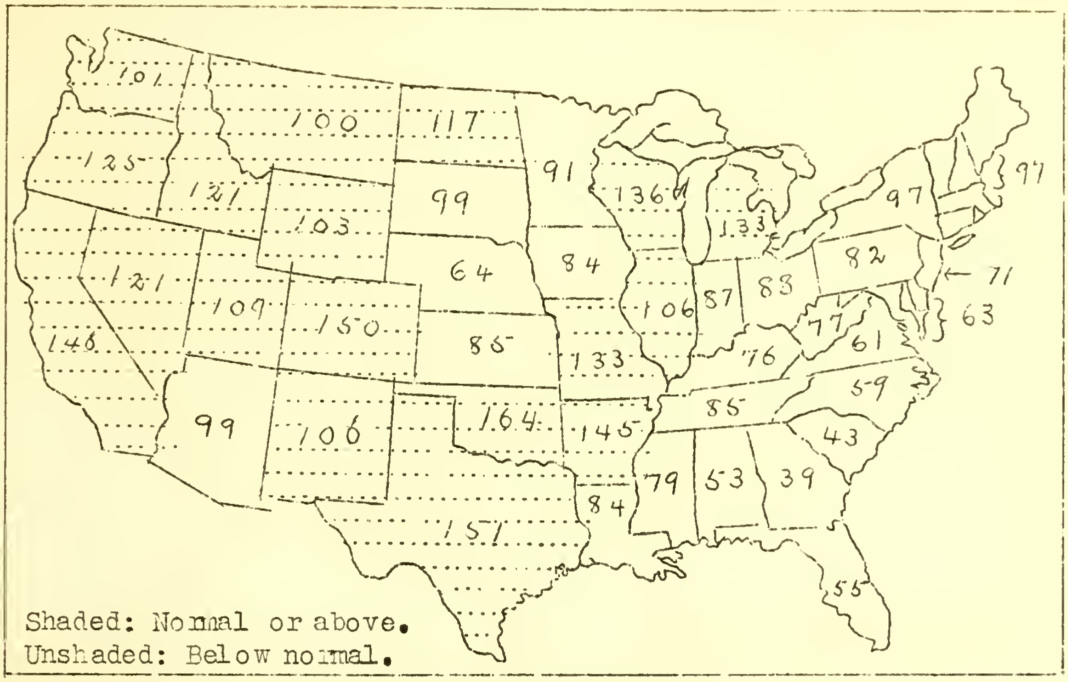

Fig. 5. Percentage of normal precipitation for the winter, December 1937 to February 1938, inclusive. (From Weekly Weather and Crop Bulletin, March 15, 1938).

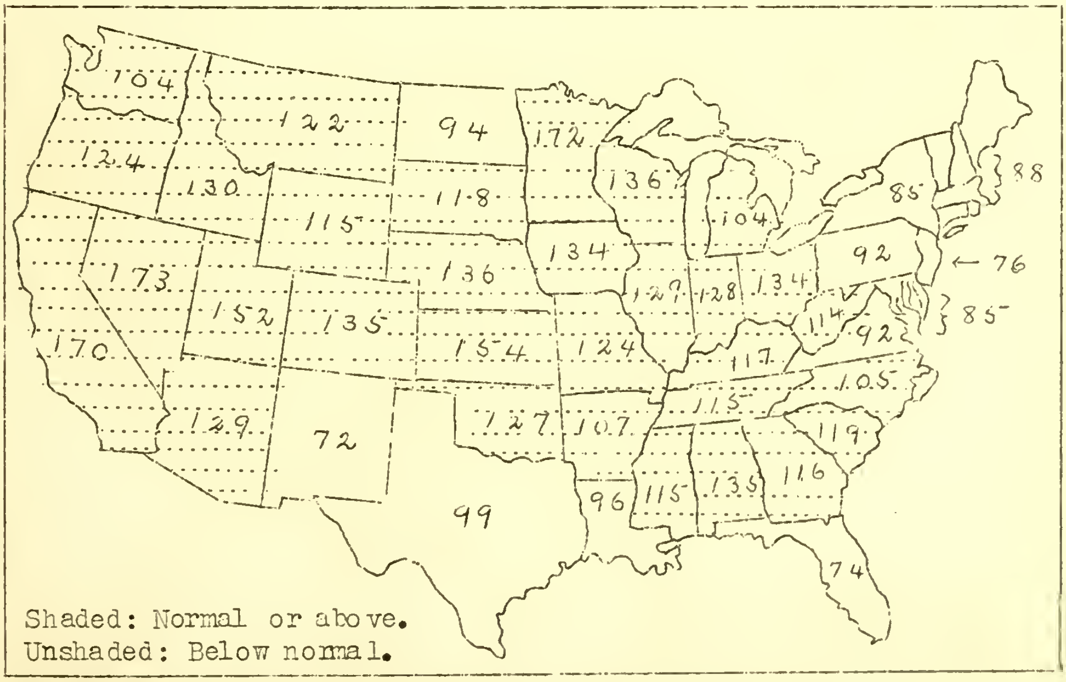

Fig. 6. Percentage of normal precipitation for the spring, March to May 1938, inclusive.

PRECIPITATION

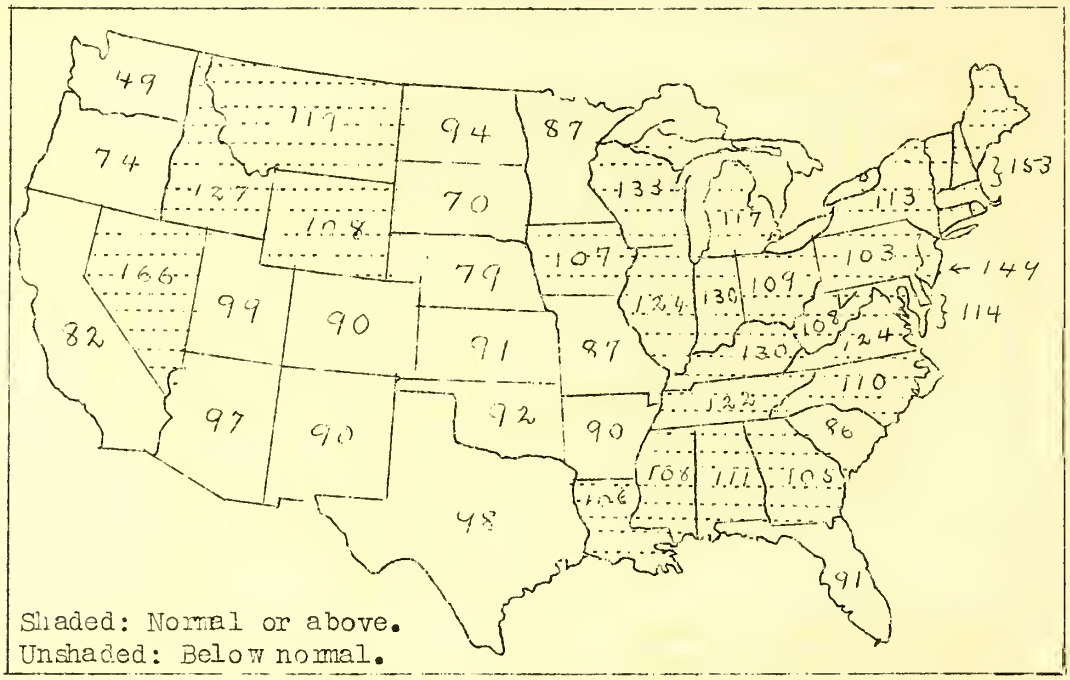

Fig. 7. Percentage of normal precipitation for the summer, June to August, inclusive, 1938. (From Weekly Weather and Crop Bulletin, September 13, 1938).

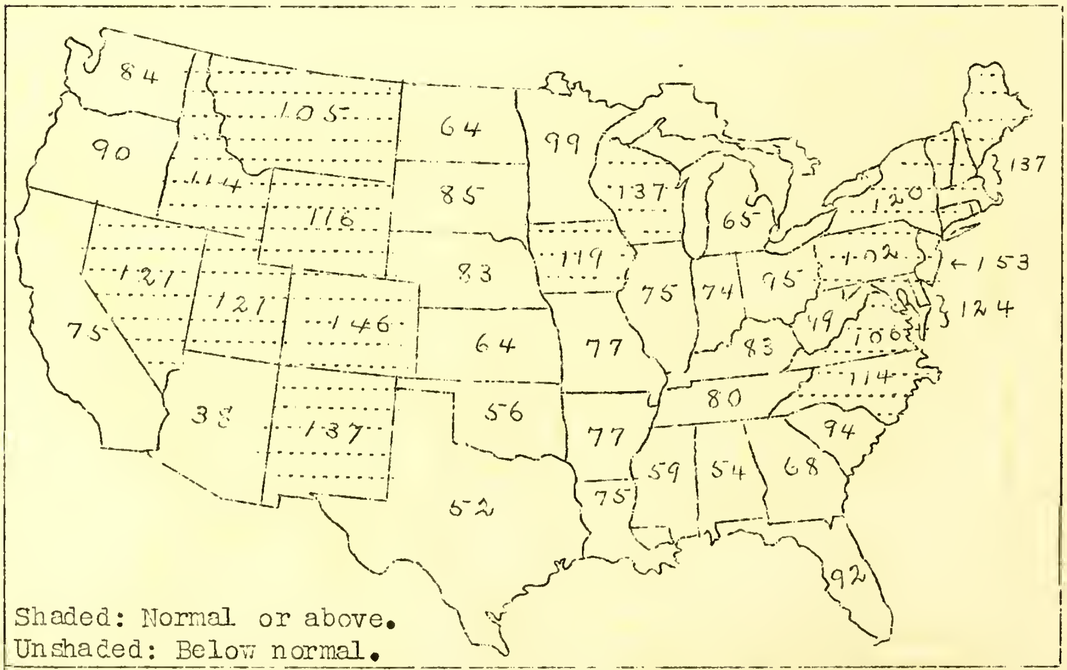

Fig. 8. Percentage of normal precipitation for autumn, September to November, inclusive, 1938. (From Weekly Weather and Crop Bulletin, December 13, 1938).

HARRISBURG, PENNSYLVANIA

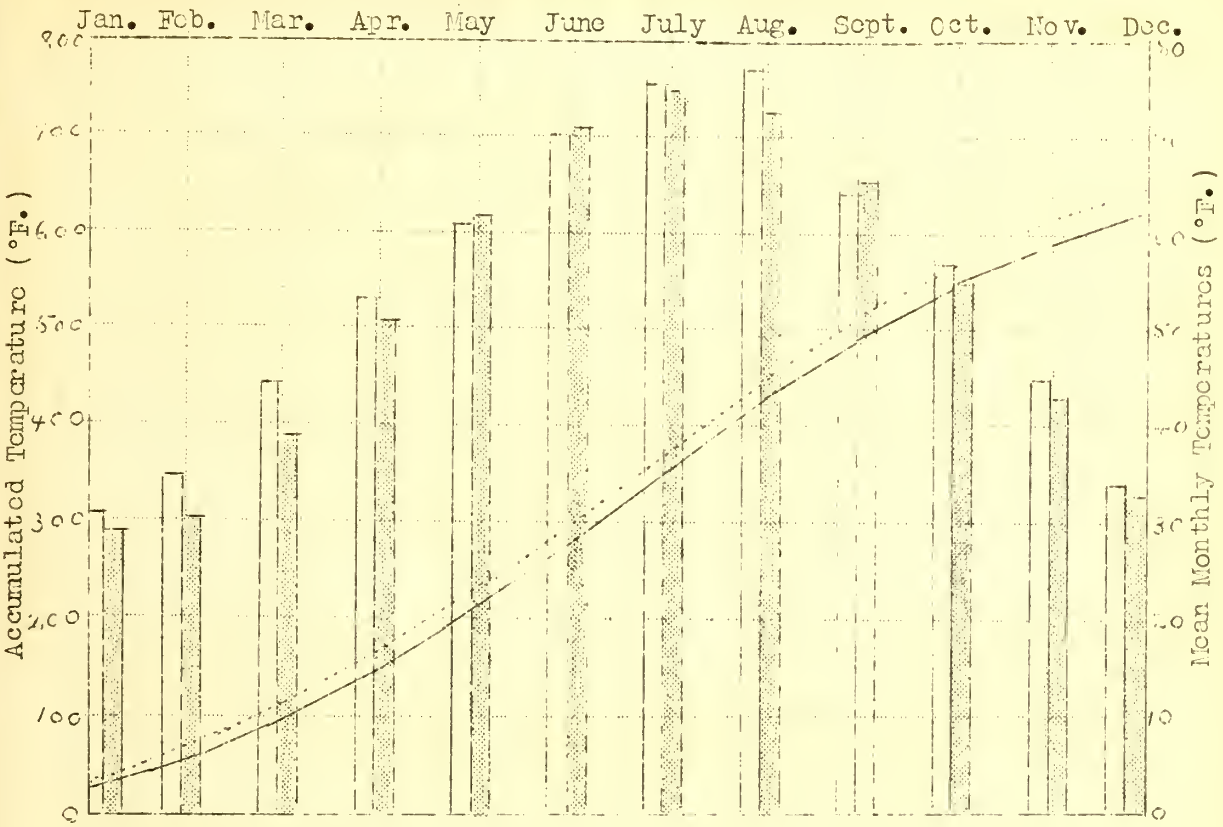

Fig. 9. Accumulated temperature in degrees F. at Harrisburg, Pennsylvania, for the year 1938 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

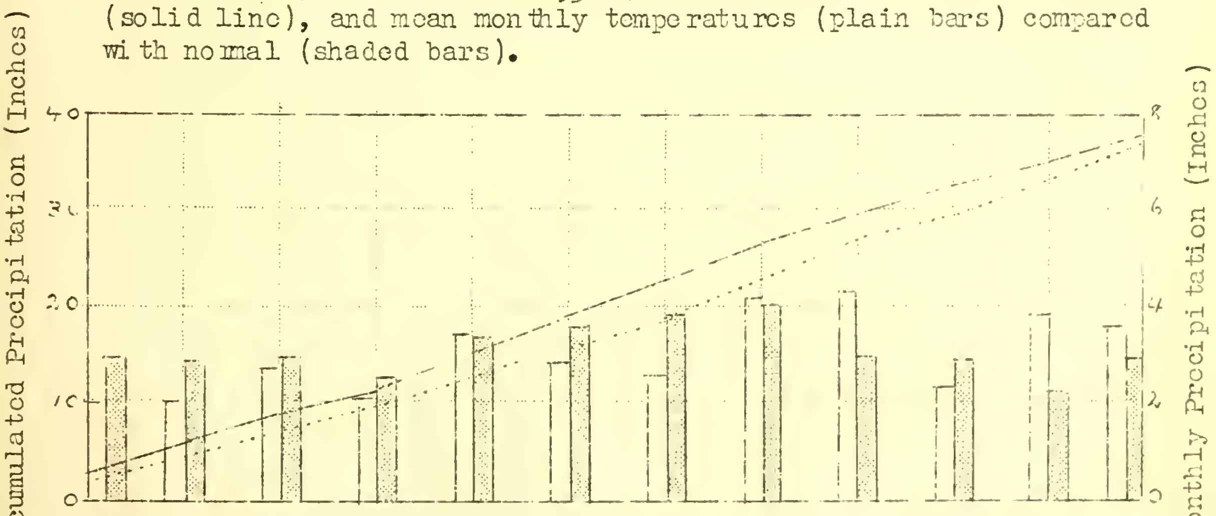

Fig. 10. Accumulated precipitation in inches at Harrisburg, Pennsylvania, for the year 1938 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

ATLANTA, GEORGIA

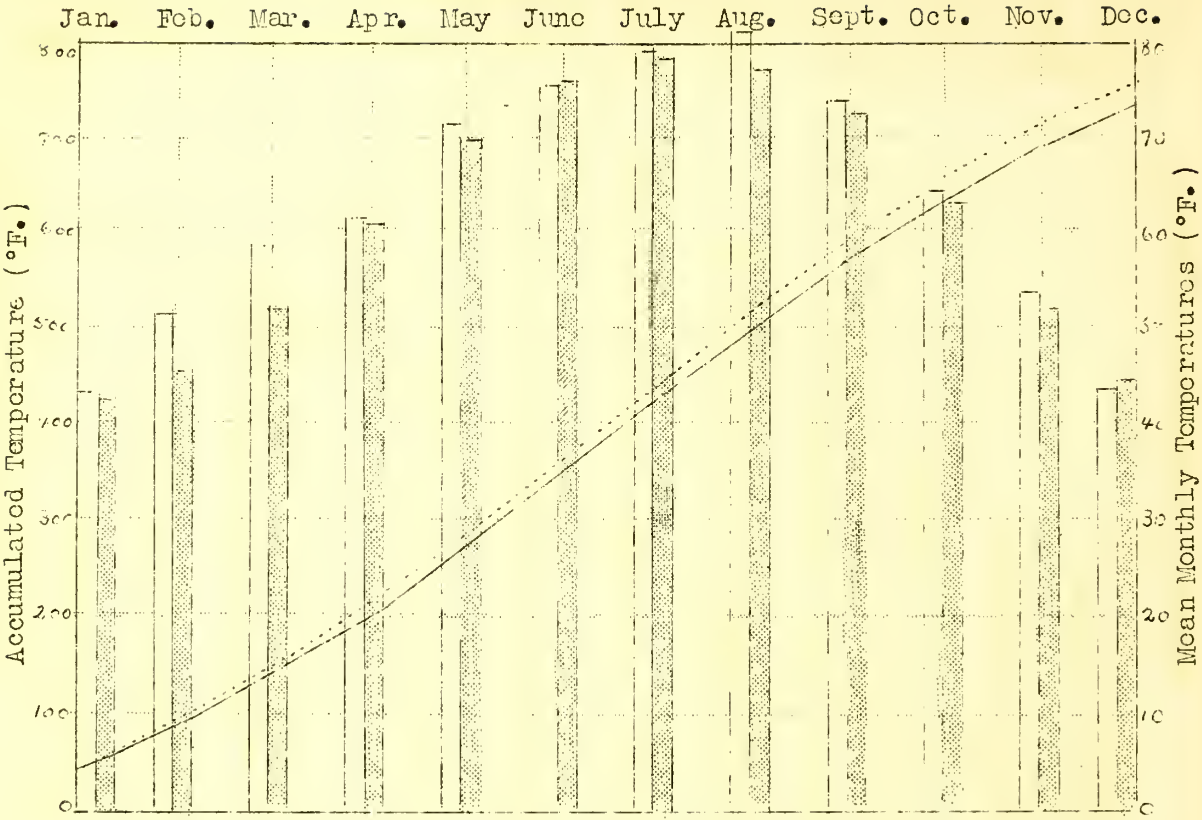

Fig. 11. Accumulated temperature in degrees F. at Atlanta, Georgia, for the year 1938 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

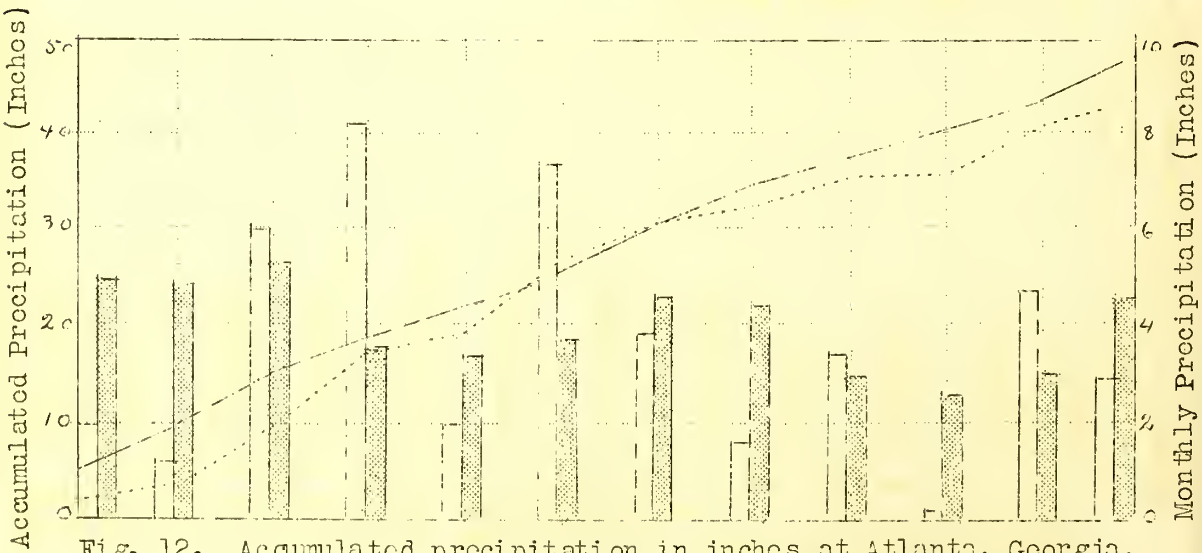

Fig. 12. Accumulated precipitation in inches at Atlanta, Georgia, for the year 1938 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

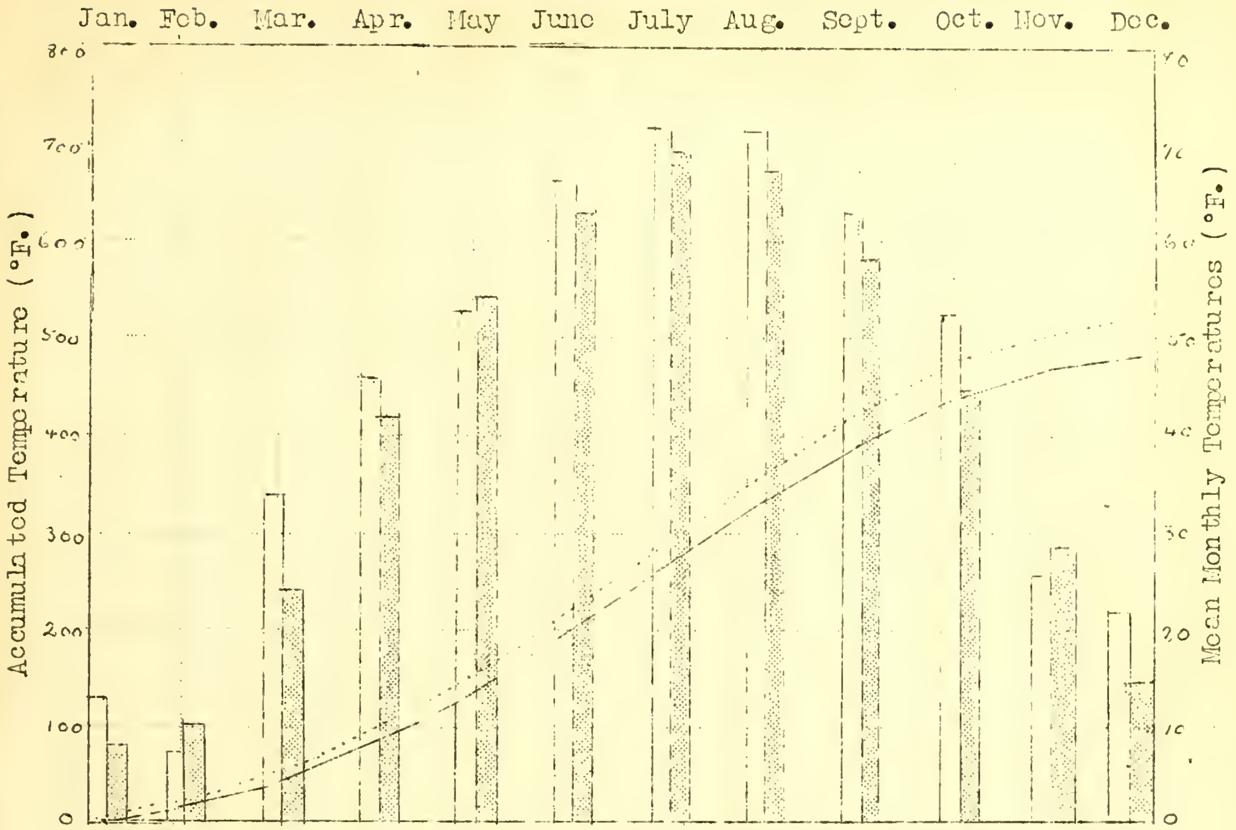

Fig. 13. Accumulated temperature in degrees F. at Bismarck, North Dakota for the year 1938 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

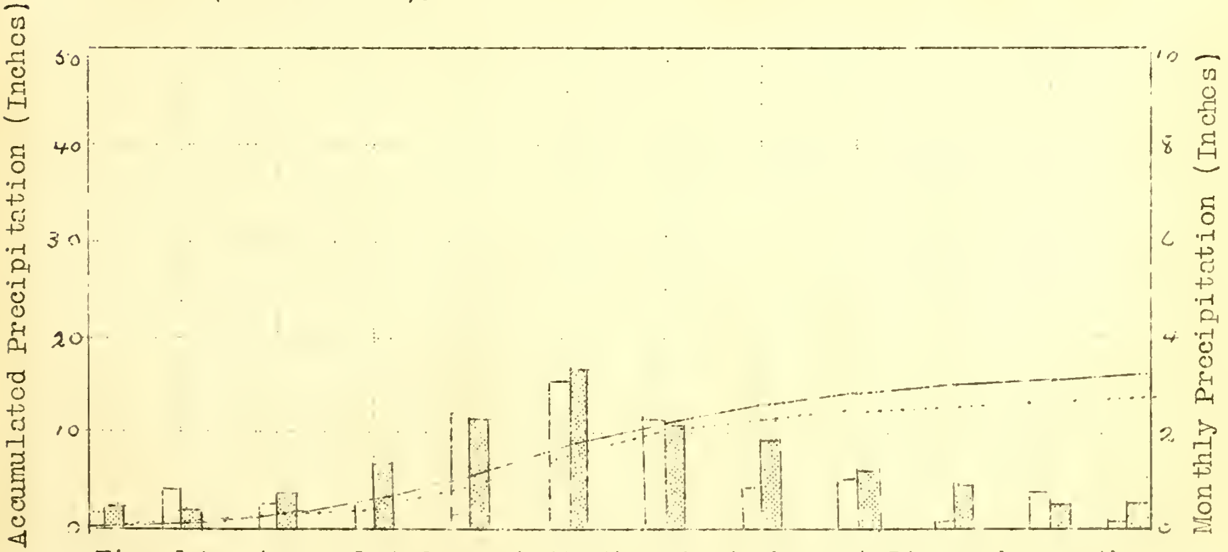

Fig. 14. Accumulated precipitation in inches at Bismarck, North Dakota for the year 1938 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

LITTLE ROCK, ARKANSAS

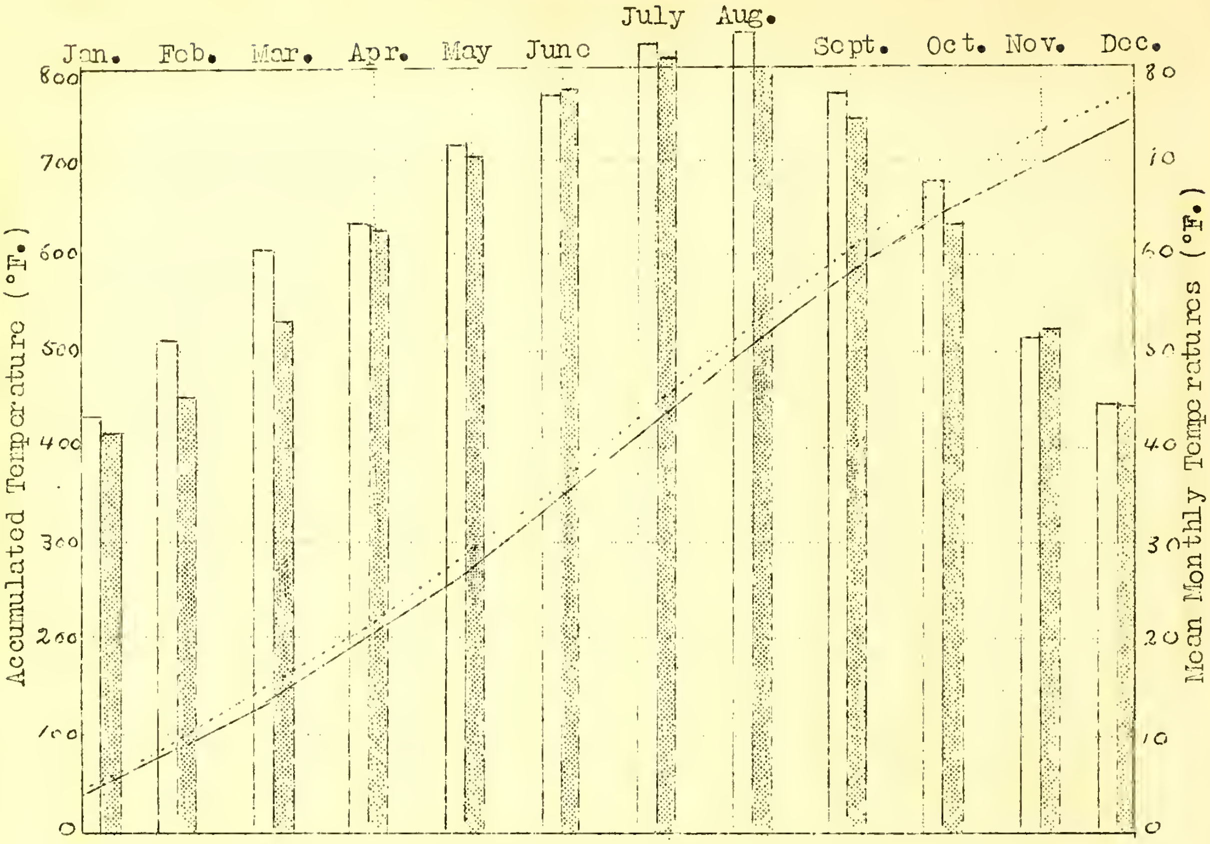

Fig. 15. Accumulated temperature in degrees at Little Rock, Arkansas, for the year 1938 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

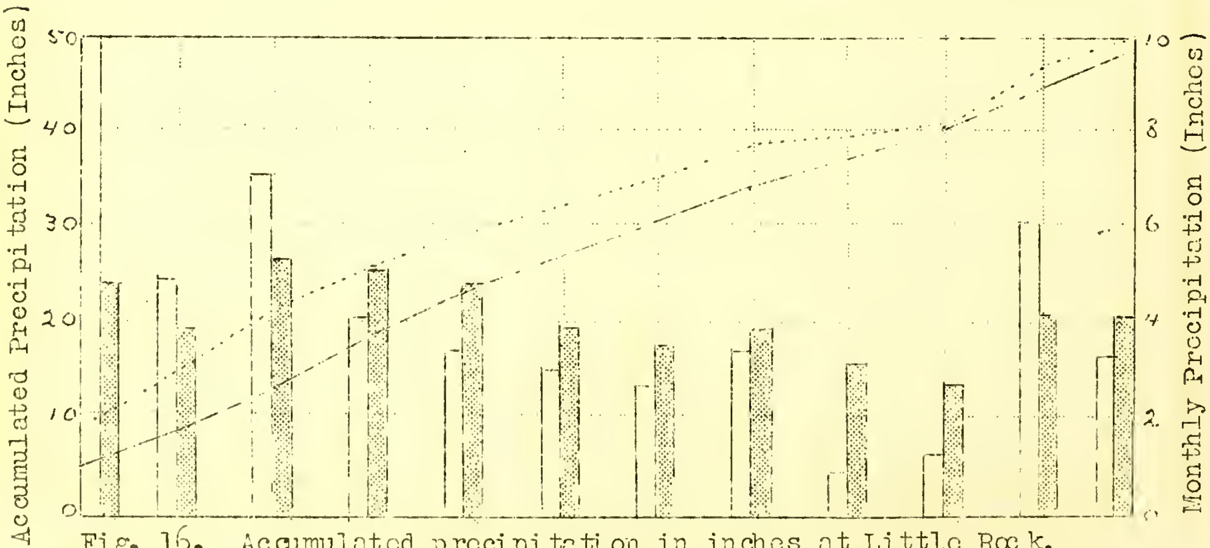

Fig. 16. Accumulated precipitation in inches at Little Rock, Arkansas, for the year 1938 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

PORTLAND, OREGON

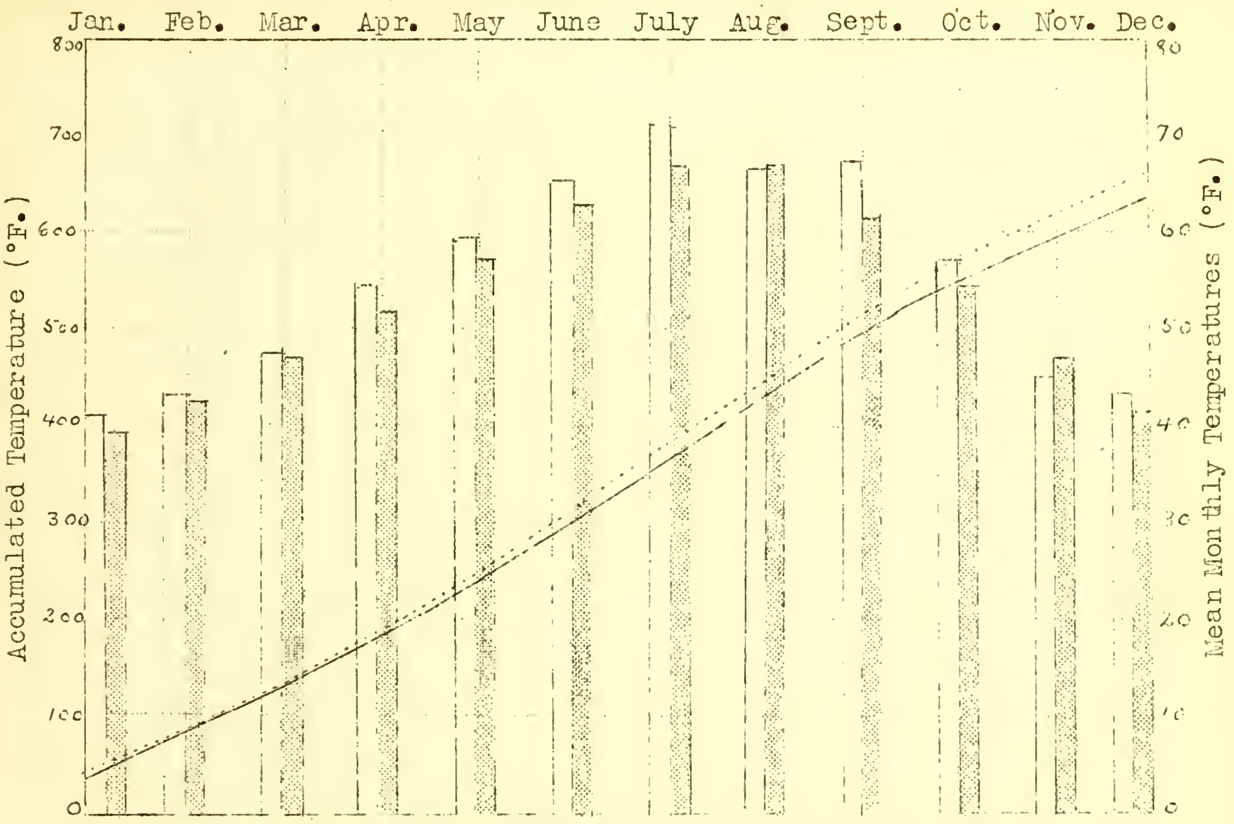

Fig. 17. Accumulated temperature in degrees F. at Portland, Oregon, for the year 1938 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

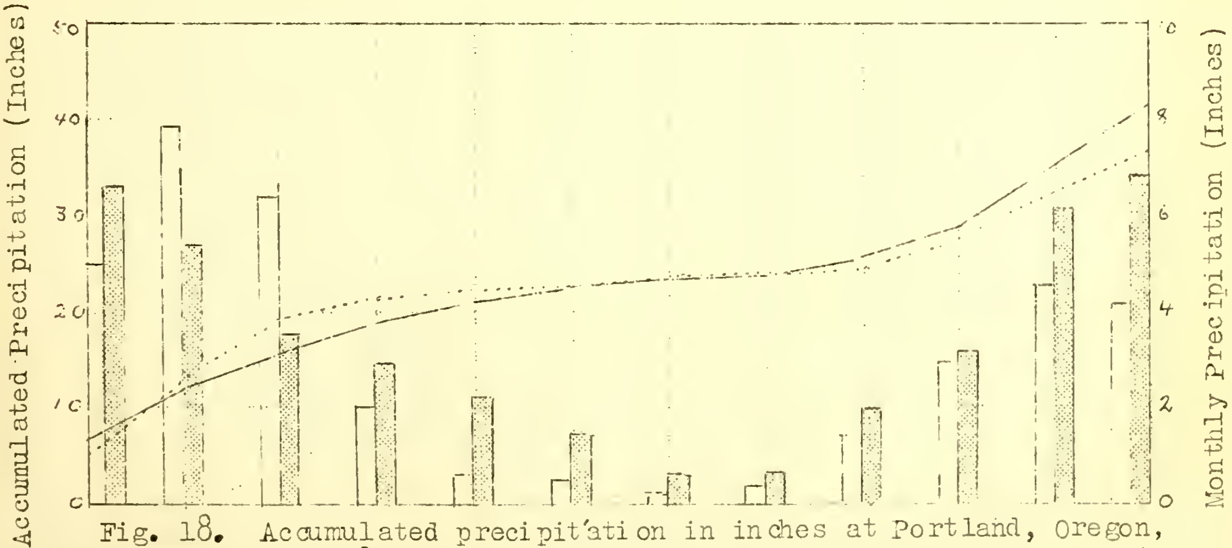

Fig. 18. Accumulated precipitation in inches at Portland, Oregon, for the year 1938 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

SACRAMENTO, CALIFORNIA

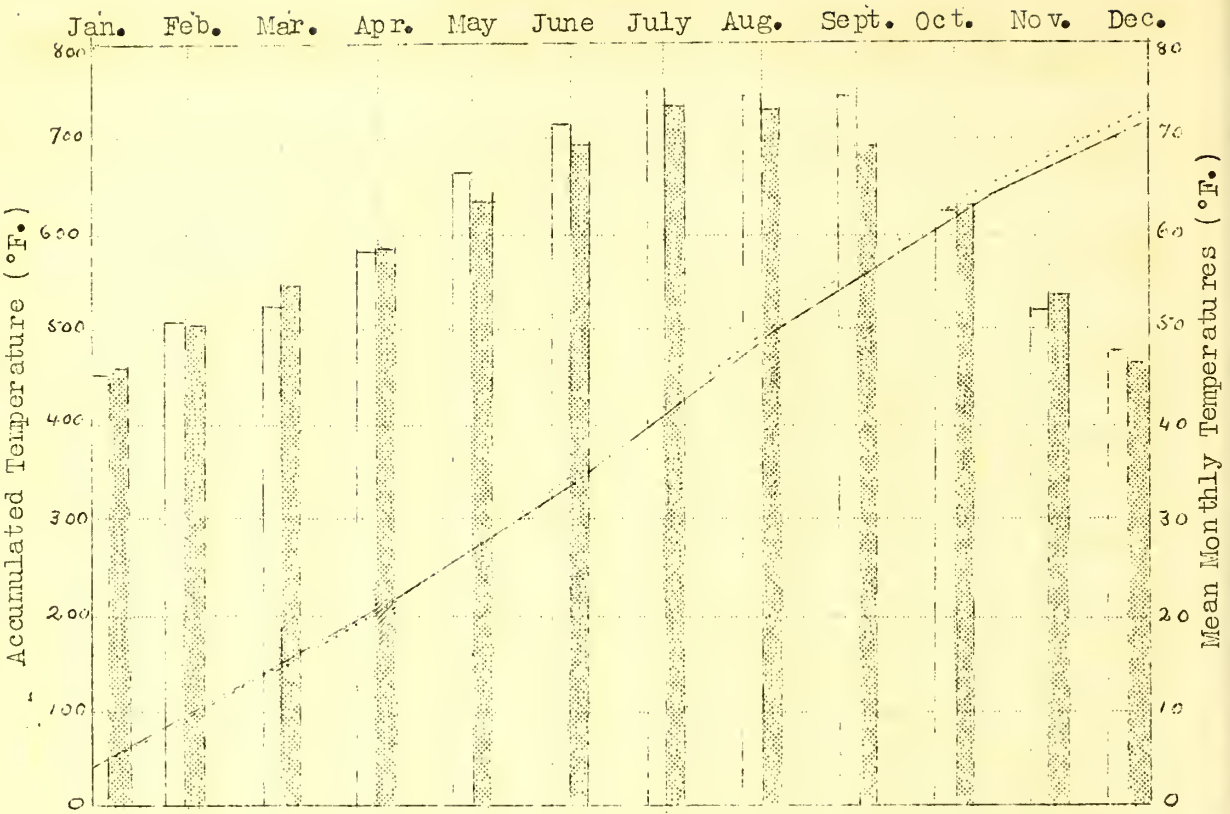

Fig. 19. Accumulated temperature in degrees F. at Sacramento, California, for the year 1938 (dotted line) compared with normal (solid line), and mean monthly temperatures (plain bars) compared with normal (shaded bars).

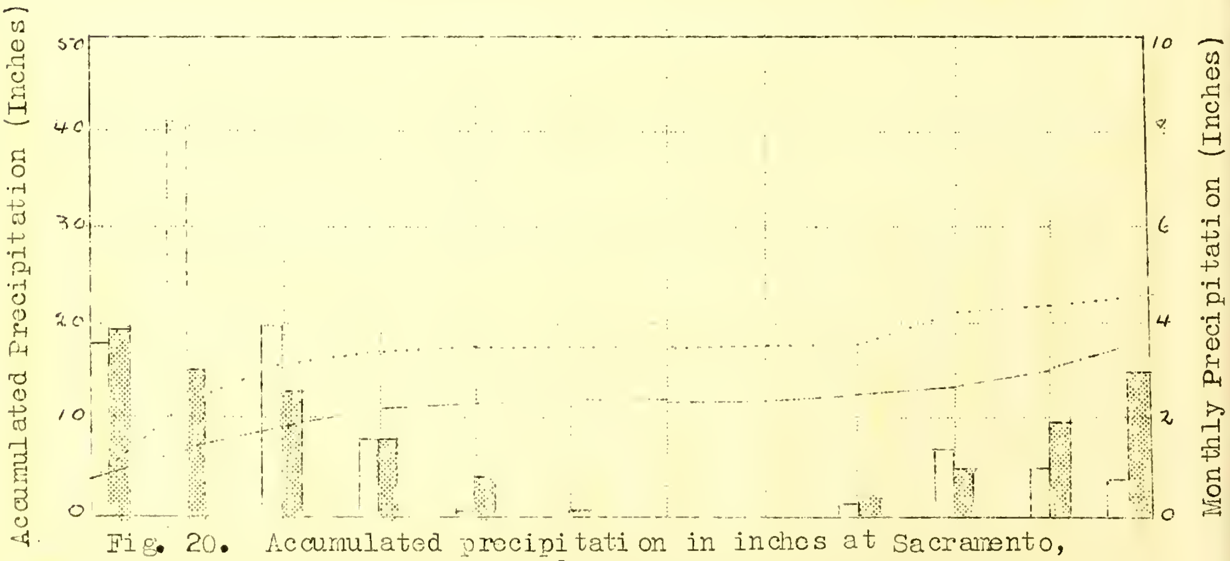

Fig. 20. Accumulated precipitation in inches at Sacramento, California, for the year 1938 (dotted line) compared with normal (solid line), and monthly precipitation (plain bars) compared with normal (shaded bars).

DISEASES OF CEREAL CROPS

A summary of the cereal rust situation in Virginia in 1938 with notes on other cereal diseases by G. E. Matheny is given in the Plant Disease Reporter, Supplement 115: 41-49. October 1, 1939.

AVENA SATIVA. OATS:

Anthracnose (Colletotrichum graminicola) was reported by K. Starr Chester as general in the southeastern counties of Oklahoma, but causing slight damage; according to H. R. Rosen, the disease was widespread on oats in Arkansas. "At the Experiment Station Farm it was especially abundant and was noted on many varieties. It was also noted in various other localities in a number of counties. Anthracnose was so common that at least part of the light weight of the grain was due to this disease" (PDR 22: 288); Illinois, one field in Carroll County.

Powdery mildew (Erysiphe graminis) was reported from New Jersey and Iowa. Foot rots (Fusarium spp.) in Massachusetts were more prevalent than usual; in Virginia a trace loss was estimated; Iowa reported 0.5 percent as the estimated loss.

Scab (Gibberella zeae) was reported from Maryland as causing a trace loss; in Illinois the Natural History Survey reported, "In Carroll County 21.7 percent of panicles with 7.5 percent infected spikelets. Average prevalence, 6.7 percent, average spikelet infection 0.54 percent "; J. J. Christensen reported scattered infection in Minnesota.

Leaf spot (Helminthosporium avenae) was observed in Virginia, Illinois, Michigan, and Iowa. Losses were negligible.

Crown rust (Puccinia coronata avenae) was reported as much more prevalent generally than in 1937. The highest estimate reported was 25 percent in New York, which is the same as last year. Although the loss was high, the yield of oats this year in New York was much better than average due to the favorable season for the growth of the plant, according to K. D. Butler and M. F. Barrus. In Iowa 24 percent loss was estimated, which was said by H. C. Murphy to be one of the most severe losses from this disease on record in this State. Wisconsin and Arkansas each reported 20 percent loss. The disease caused the most severe damage in recent years in Wisconsin, according to R. E. Vaughan, who also reported considerable breaking and lodging attributed to rust; C. O. Johnston reported crown rust as general in the eastern half of Kansas and the most severe ever observed, the estimated loss being 15 percent for the State. Other loss estimates of 1 percent or more were 8 percent in Minnesota, 3 in Maryland and Virginia, 2.5 in Illinois, 2 in Massachusetts, Georgia, and Oklahoma, 1.5 in Ohio, and 1 in North Carolina and Indiana. Other reports concerning the development of the

disease in 1938 have been given in the Reporter (PDR 22: 103, 117, 135, 181, 206, 208, 242-245, 369-371).

Red leather leaf disease (Pseudodiscosia avenae) was common on winter oats in Oregon. The disease appears to be increasing in abundance from year to year (PDR 22: 175).

Stem rust (Puccinia graminis avenae) was relatively unimportant except in Illinois, Virginia, and Pennsylvania, where 10, 4, and 3 percent loss respectively was estimated. In New York, K. D. Butler and M. F. Barrus reported weather conditions apparently favorable but inoculum scarce. Although the disease occurred early in the State it did not build up until late, with consequent small damage, which was estimated at 2 percent. In Kansas, C. O. Johnston reported the disease fairly general in the eastern half of the State but developing late, resulting in a loss of 3 percent. Other losses were 1 percent in Massachusetts and Missouri, and traces or no loss in other States reporting.

Smuts, loose and covered (Ustilago avenae and U. levis): Losses caused by smut were approximately equal to those recorded for 1937, with the exception of 10 percent loss in Oklahoma this year as compared with 6 percent for last year. Reports were received from 22 States, with average losses from trace to 14 percent. Excellent results were obtained from seed treatment, but in some States, owing to lack of money on farms, only small amounts were treated. Percentage losses were estimated as follows: Pennsylvania, 14; Massachusetts, 12; Oklahoma, 10; Wisconsin, 8; Virginia, 6.5; Maryland, 5; Iowa, 4; Illinois, 3.7; New York, 3.5; Georgia, 3; Kansas, 2.3; Arkansas, Ohio, Indiana, and Minnesota, each 2; North Dakota and Wyoming, each 1; Michigan, 0.5; Washington, 0.3; elsewhere estimates not given.

Halo leaf blight (Bacterium coronafaciens) was much less prevalent in Illinois than for several previous years, according to the report of the Natural History Survey, "Seen in only 2 of the fields examined"; general in Minnesota; less prevalent than last year in Iowa, 0.5 percent reduction in yield was estimated; North Dakota, "Not observed this year."

Blast (cause unknown), although less prevalent than last year, caused 15 percent loss in Illinois, which was the same amount reported in 1937. In New York, according to M. F. Barrus and K. D. Butler, this disease, although common in every field, was not nearly as severe as last year. Pennsylvania estimated 1 percent loss; other States reporting estimated from a trace to 0.5 percent.

BARLEY. See HORDEUM VULGARE.
CORN. See ZEA MAYS.
FLAX. See LINUM USITATISSIMUM.

HORDEUM VULGARE. BARLEY:

Ergot (Claviceps purpurea) was found in one barley field of about 5 acres in Lee County, Illinois. According to G. H. Boewe, this disease seldom occurs on this host in Illinois, but it was more prevalent in this one field than has been reported in any previous record for the State (PDR 22: 287-288). The disease was also observed in Wisconsin, Minnesota, and North Dakota.

Powdery mildew (Erysiphe graminis) caused a loss of 10 percent in New York, according to M. F. Barrus and K. D. Butler. They reported that it was difficult to estimate losses as rust occurred at the same time. In Virginia, G. E. Matheny reported that the disease appeared early, developed rapidly, and caused appreciable damage in many fields. He estimated a total loss of 2.5 percent for the State. Other estimates reported were as follows: Pennsylvania, 2 percent; Iowa, 1.5; North Carolina and Wisconsin, 1; Washington, 0.8; Oregon, 0.6; Illinois, 0.5; Ohio, Oklahoma, and Idaho, each a trace.

Scab (Gibberella zeae) was generally more prevalent than in 1937, or in an average year. In Illinois and Iowa, losses of 6 percent and 5 percent, respectively, were estimated in 1938, as compared with 0.1 percent and 0.5 percent in 1937. Other States reporting more than a trace were Wisconsin, 2.5 percent; Virginia, 2; Maryland, 1.5; Minnesota and North Carolina, 0.5; Michigan, 0.3.

Stripe (Helminthosporium gramineum) was widely reported as usual. In some States the disease was more prevalent than last year. According to M. F. Barrus and K. D. Butler, there was a 5 percent reduction in yield in New York, owing to favorable weather conditions. In Pennsylvania R. S. Kirby reported the disease found in 50 percent of fields planted with untreated seed, and in no field of the 6 examined that were planted with treated seed. He estimated the reduction in yield at 0.2 percent. In Minnesota, J. J. Christensen stated that recent years have been too dry for sporulation and external seed infection. Other States in addition to New York reporting more than 1 percent loss were North Carolina, 3 percent; and Virginia, 2 percent.

Head blight (Helminthosporium sp.) was reported by W. E. Brentzel as less prevalent than in 1937 in North Dakota, where he estimated 0.5 percent loss. Spot blotch (Helminthosporium sativum) was slightly more prevalent than in 1937. Not over 1 percent loss was reported from any State; those reporting 1 percent were Pennsylvania, Virginia, North Carolina, Wisconsin, and Iowa. Toadstool (Naucoria cerealis): G. H. Boewe reported the occurrence of this new toadstool species in Illinois (PDR 23: 24).

Leaf rusts: Puccinia anomala was much more prevalent in New York than last year, according to M. F. Barrus and K. D. Butler. They

reported 10 percent reduction in yield and stated that it was difficult to estimate accurately the amount of loss, as mildew occurred on some of the plants. The disease was worse in some localities, the maximum infection observed being 45 percent. In Pennsylvania, R. S. Kirby reported the disease more prevalent than in 1937 or in an average year. "An average of 11.5 percent infection was found in 15 fields. Leaf rust found in 73.3 percent of fields surveyed." Estimated loss was 1 percent for State. The Natural History Survey in Illinois reported the disease much more prevalent than last year, causing a reduction in yield of 5 percent. It was also reported more prevalent in Virginia than last year, causing a total loss of 3 percent. Other States reporting losses were Iowa, 2.1 percent; North Carolina and Nebraska, each 1; Indiana, Minnesota, Kansas, Oklahoma, Washington, and Oregon, each a trace; California (PDR 22: 181). P. rubigo-vera tritici was reported from Iowa by D. R. Shepherd as causing 20 percent reduction in yield.

Stem rust (Puccinia graminis tritici): In Wisconsin, Illinois, Minnesota, Iowa, North Dakota, South Dakota, and Nebraska, the area where stem rust was so severe on barley last year, losses were greatly reduced, being estimated at a trace, 1 percent, 0.5 percent, 1 percent, 1 percent, trace, and 1 percent, respectively, as compared to 12 percent, 20 percent, 5 percent, 15 percent, 8 percent, 3 percent, and 2 percent, in 1937. New York and Virginia reported more than last year. In Virginia, G. E. Matheny reported that the disease was most severe on barley grown near barberries, and that all commercial varieties grown seemed to be susceptible. As indicated on the map (Fig. 21), these 2 States show the highest losses for 1938.

Net blotch (Pyrenophora teres): M. F. Barrus and K. D. Butler write from New York as follows: "We have no report on this disease, although it probably occurred to a slight extent rather generally." In Pennsylvania, according to R. S. Kirby, a trace was found in 3 out of 15 fields surveyed. Other States reporting the disease were Oklahoma, Illinois, Michigan, Wisconsin, and California.

Scald (Rhynchosporium secalis) was reported by R. E. Vaughan as less prevalent than for several previous years in Wisconsin; in Minnesota, the disease was prevalent especially on introduced lines and varieties; in Oregon, Roderick Sprague reported the disease very destructive (PDR 22: 174); the disease in California, as reported by C. A. Suneson, severely attacked culms and glumes of many varieties (PDR 22: 143, 181).

Covered smut (Ustilago hordei) was less prevalent generally than in 1937. Two percent total loss was reported from New York, which is 1 percent less than was reported last year. M. F. Barrus and K. D. Butler reported that seed treatment was much more general than last year in the State. Pennsylvania reported 4 percent loss as compared with 9.4 percent for last year. R. S. Kirby writes as follows: "An average of 4.06

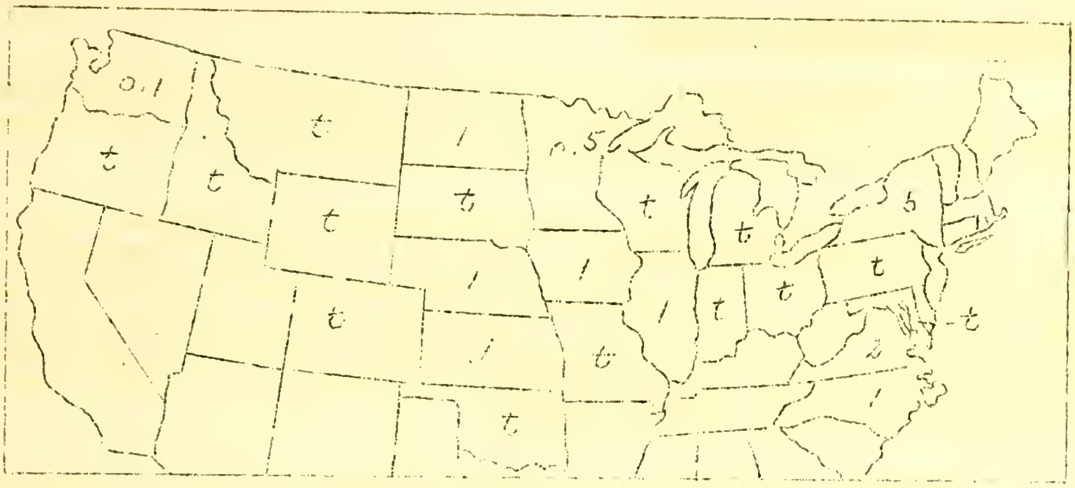

Fig. 21. Estimated percentage loss from stem rust of barley in 1938.

percent was found in 15 untreated fields with 80 percent of the fields planted with untreated seed having smut. An average of .05 percent was found in 13 fields planted with treated seed." Estimated losses of 1 percent or more were: Tennessee, 10; Maryland, Virginia, and Oklahoma, 3; Iowa, 2.5; Kansas, 1.5; Wisconsin, 1.2; North Carolina, Arkansas, Montana, Wyoming, and Colorado, 1. Other States estimating less were: Indiana, Illinois, Michigan, Wisconsin, Minnesota, North Dakota, Idaho, Washington, and Oregon.

Loose smut (Ustilago spp., U. nuda) was also reported less prevalent generally than during 1937. Percentage losses reported for loose smut, except in New York and Pennsylvania, were less than for covered smut this year. In Pennsylvania, R. S. Kirby reported as follows: "An average of 4.83 percent loose smut occurred in fields (15) planted with untreated seed, and all fields had loose smut. An average of 1.43 percent loose smut occurred in fields planted with treated seed." The following estimates were reported: Tennessee, 5 percent; Pennsylvania, 4.8; Maryland, 3; New York and Virginia, 2.5; Oklahoma, 2; Wisconsin, Kansas, North Carolina, and Arkansas, 1; Iowa, 0.5; Illinois and Washington, 0.2; Michigan and North Dakota, 0.1; Indiana, Minnesota, Montana, Wyoming, and Colorado, a trace.

Basal glume rot (Bacterium atrofaciens) was reported from Putnam County, Illinois, by the State Natural History Survey. Bacterial blight (Bacterium translucens) in Iowa caused 1 percent reduction in yield this year as compared to 8 percent in 1937. Illinois and Minnesota reported the disease, but did not estimate losses.

LINUM USITATISSIMUM. FLAX:

Wilt (Fusarium lini) was of the usual prevalence in Minnesota and North Dakota, and caused 1 percent loss in each State. In Wisconsin, less than last year or in an average year was reported.

Rust (Melampsora lini) was more prevalent in Wisconsin and Minnesota than for several years. The latter reported 1 percent loss. W. F. Buckholtz reported the disease much more prevalent in Iowa than last year or in an average year. Severe infection in Benson County, North Dakota, was reported by W. E. Brentzel. In Texas, G. E. Altstatt reported flax rust on cultivated flax. Two fields in Victoria County were heavily infected (PDR 22: 137).

Damping-off (Pythium sp.) in Iowa caused 10 percent reduction in yield. Pasmo (Sphaerella linorum): Scattered infection was reported in Wisconsin and Minnesota, with less than usual in Minnesota.

Heat canker (non-parasitic) was observed in Minnesota and North Dakota, with the usual prevalence in both States, and with 0.5 percent loss in North Dakota.

ORYZA SATIVA. RICE:

Leaf spot (Cercospora oryzae): Heavy incidence of the disease did not occur in Louisiana until the last half of August. Most fields of Blue Rose were almost completely browned by the fungus at the time of maturity. This leaf spot was more prevalent in the Southwest Prairie region than in the river sections (PDR 22: 448). According to T. C. Ryker, it was not possible to estimate loss, since the disease was uniformly spread in every field of Blue Rose. Early Prolific matured before it was seriously damaged. The disease was found July 14 on rice plants in the nursery at the Rice Branch Experiment Station, Stuttgart, Arkansas, and on plants in commercial fields in the vicinity (PDR 22: 348). The most susceptible varieties were Early Prolific, Lady Wright, and Blue Rose.

Black leaf smut (Entyloma oryzae): In Louisiana, T. C. Ryker reported a trace loss, with all varieties apparently susceptible. The disease was reported from Arkansas and Texas (PDR 22: 348).

Leaf and glume spot (Ophiobolus miyabeanus [Helminthosporium oryzae]): In Louisiana this disease was present in most fields. However, only an occasional field, mostly on heavier soils, showed a severe incidence (PDR 22: 448). T. C. Ryker reported that it had not been possible to estimate the damage. There was probably a small reduction in yield, but the principal damage was a lowering of the grade of the rice. Leaf spot was generally present in the rice-growing areas around Stuttgart, Arkansas, and Beaumont, Texas. The spotting of plants was

more severe in Texas than in Arkansas. A few severely spotted fields were reported, but only a trace was found in commercial plantings (PDR 22: 348).

Stem rot (Leptosphaeria salvinii [Sclerotium oryzae]): In Louisiana, according to T. C. Ryker, the disease appeared principally under conditions unfavorable for growth of the host. It was observed in several fields but did not cause any serious loss. In Arkansas, E. M. Cralley reported the usual prevalence, and that all the commonly grown commercial varieties were moderately or very susceptible. "Alternate submergence and drainage retards development of disease. Heavy applications of potash, in certain areas, apparently reduce the amount of lodging due to disease."

Blast, leaf spot, rotten-neck (Piricularia oryzae) was observed to be prevalent in four fields in Louisiana. Two fields were of the variety Early Prolific and two were Blue Rose (PDR 22: 448). A trace loss was estimated for the State. Leaf spot was observed in Texas (PDR 22: 348). From Arkansas, E. M. Cralley reported as follows: "Serious on new or very rich soil where rice growth is very luxuriant. Of little consequence on old rice land." (PDR 22: 348).

Seedling blight (Rhizoctonia solani): In Louisiana, following a rather prolonged wet period during the entire month of July, R. solani was observed to produce a rather serious disease condition in certain rice fields (PDR 22: 448). Seedling blight in the State caused only a trace loss owing to the continued warm weather. The disease also appeared in Arkansas. Sheath spot (R. oryzae) caused a trace loss in Louisiana, where it was favored by periods of frequent rainfall during July.

Smut (Tilletia horrida) was more prevalent than last year in Louisiana. T. C. Ryker reported that in every instance except one the disease was found only in the Rexora variety, and for the most part occurred in the river sections or fields planted to rice for the first time in the prairie region.

Straighthead (non-parasitic) in Arkansas was serious only on new land, and was said to be controlled by proper irrigation practices.

White-tip (non-parasitic), in Louisiana, was apparently favored by high temperature. Early Prolific, which is very susceptible, matured before it was severely affected. The disease did not occur to any extent in the river sections (T. C. Ryker).

RICE. See ORYZA SATIVA.
RYE. See SECALE CEREALE.

SECALE CEREALE. RYE:

Ergot (Claviceps purpurea) was less prevalent than in 1937. The only States reporting more were Wisconsin and Minnesota, with 2 percent and 1 percent, respectively. Other States reported as follows: Virginia, 0.1 percent; Iowa, 0.5; Michigan, 0.1; Massachusetts, New York, Pennsylvania, North Dakota, and Montana, each a trace.

Anthracnose (Colletotrichum graminicola) was also reported less prevalent than during 1937. Losses were estimated at 4 percent in Pennsylvania, 2 in North Carolina, 0.1 in Virginia, Michigan, and Iowa, and a trace in Wisconsin. Powdery mildew (Erysiphe graminis) was observed in small amounts in New York, New Jersey, Michigan, and Virginia.

Footrot and seedling blight (Fusarium spp. and Helminthosporium spp.) were reported from 6 States, with losses as follows: Iowa, 10 percent; Massachusetts, 5; North Carolina, 2; New York, Wisconsin, and North Dakota, each a trace. Scab (Gibberella zeae) was reported from Wisconsin by R. E. Vaughan as causing a trace loss. Toadstool (Naucoria cerealis): G. H. Boewe reported the occurrence of this new toadstool species in Illinois (PDR 23: 24). Take-all (Ophiobolus graminis): Oklahoma, "One record."

Stem rust (Puccinia graminis secalis) was reported as more prevalent than in 1937; however, no State reported more than 1 percent loss. The States reporting 1 percent loss were: Massachusetts, New York, Virginia, Oklahoma, and Iowa. Leaf rust (Puccinia rubigo-vera secalis) was reported as more severe in Virginia and Iowa, and much more severe in Oklahoma, than in 1937. Losses were estimated as follows: Pennsylvania and Oklahoma, each 3 percent; Virginia and Georgia, each 1; Wisconsin, 0.5; Michigan and Iowa, each 0.1; Tennessee, Washington, and Oregon, each a trace; observed in New York; Minnesota, no loss.

Scorch (Rhynchosporium secalis) was as usual very destructive on barley in Oregon and it was also present in the plots at Granger, Oregon, on rye (PDR 22: 174). Scorch, or streak, (Scolecotrichum graminis) was found on about 40 percent of the leaves of a field of rye in Oregon in May, only the second time that this fungus has been seen on rye in the State (PDR 22: 174). Stem smut (Urocystis occulta) was reported as of minor importance with negligible losses.

SORGHUM VULGARE. SORGHUM:

Rust (Puccinia purpurea) was reported from 3 counties in Texas.

Root rot (Pythium sp.): Two reports were received from Texas. In California, J. T. Middleton reported that P. arrhenomanes was consistently isolated from diseased roots of milo obtained from the upper Delta region, where the disease was prevalent on susceptible

varieties (PDR 22: 355); in Kansas, L. E. Melchers reported as follows: "This disease has been present in Kansas since 1930 or longer in small amounts. No survey ever made and its distribution unknown."

Lodging (Sclerotium bataticola): Fields of sorghum in the Panhandle and other sorghum-growing regions of northwest Texas were affected by lodging to a damaging extent (PDR 22: 402-403). Root and stalk rot (S. bataticola) in Oklahoma, according to Chester, was "Common, and possibly some of the trouble often attributed to the milo disease is really due to S. bataticola."

Covered kernel smut (Sphacelotheca sorghi) was reported from 5 counties in Texas; Oklahoma, percentage of smut found in sorghum fields was 24, by count of 400 heads; R. E. Vaughan reported the usual prevalence in Wisconsin; Kansas estimated a total loss of 2.8 percent; in Wyoming there was a total loss of 15 percent in seed production and slight loss in forage, according to the report of G. H. Starr.

Bacterial stripe (Bacterium andropogoni) was reported from Texas only. Leaf spot (Bacillus sorghi and Bacterium sorghi) was reported from Illinois. Bacterial streak (Bacterium holcicola) was reported from Hidalgo County, Texas.

Weak neck (cause unknown): A disease noted for the first time in sorghum last year was again in evidence at the Fort Hays Experiment Station, Hays, Kansas. The disease was most evident in certain milo hybrids and more severe in early than in late plantings (PDR 22: 409).

TRITICUM AESTIVUM. WHEAT:

Ergot (Claviceps purpurea): In New York, according to K. D. Butler, ergot was rare, being found only in threshed grain from one field. The Natural History Survey reports 2 records for Illinois: "Logan County, one head seen in 30-acre field; Macoupin County, one head in 20-acre field." Traces were observed in Wisconsin, Minnesota, and North Dakota.

Anthracnose (Colletotrichum graminicola): In Texas some damage was caused by this disease (PDR 22: 242). The Natural History Survey reports 3 records for Illinois: "Massac County, 4.7 percent of plants in 40 acres; Washington County, 0.4 percent in 50 acres; in White County, 2 percent in 30 acres." In Kansas an unusually large amount of anthracnose was observed in eastern counties (PDR 22: 245).

Powdery mildew (Erysiphe graminis) caused a reduction in yield of 2 to 3 percent in New York, largely a guess, according to M. F. Barrus and K. D. Butler. At Arlington, Virginia, J. W. Taylor reported that mildew on wheat was the heaviest ever observed. G. E. Matheny reported the disease more prevalent than last year or in an average year, with

an estimated loss of 2 percent. In South Carolina, George M. Armstrong reported the infection of mildew on wheat was the heaviest this year that he had ever observed (PDR 22: 337). I. M. Atkins reported mildew also prevalent in Texas. In Ohio there was a trace + to 5 percent of mildew (H. B. Humphrey). Other States reporting the disease were: Michigan, Minnesota, Iowa (1 percent), Kansas, Utah, and Washington.

Footrots and rootrots, and seedling blight caused by various organisms: Footrot (Cercosporella herpotrichoides) was found in scattered sections through Nez Perce and Camas prairie areas in Nez Perce, Lewis, and Idaho Counties, Idaho, on June 28. It was found in previously unreported areas, but was most severe in the eastern portion of Lewis County. It was estimated that the loss in one 800-acre field of Oro wheat would be 50 to 60 percent. Other fields in this particular section suffered considerable loss (PDR 22: 346, 372). In Washington, the disease was reported from Walla Walla County and other sections of the State (PDR 22: 346). Fusarium spp. and Helminthosporium spp. including H. sativum were reported from 10 States, causing losses estimated as follows: Colorado, 10 percent; North Dakota, 2; North Carolina, 1; Washington, 0.7; Oregon, 0.8; Michigan, 0.1; Pennsylvania, Wisconsin, Oklahoma, and Montana, each a trace. Minnesota and Iowa reported the same prevalence as last year. Mushroom death (Marasmius tritici) was observed in 7 counties in Illinois, according to the Illinois Natural History Survey. Toadstool (Naucoria cerealis) was reported by G. H. Boewe in Illinois from Champaign, Macoupin, Morgan, Washington, and White Counties, thus adding 5 counties to its known range (PDR 23: 24-27).

Take-all (Ophiobolus graminis) in New York was more prevalent than last year, according to M. F. Barrus and K. D. Butler, who estimated a reduction in yield of 0.5 percent. In Kansas, Hurley Fellows reported take-all foot rot quite abundant, particularly on the heavier soils in certain sections of central Kansas. The crinkle joint symptom in the upper joint was more prevalent this year than ever before, probably because of the excess moisture throughout central Kansas and the late appearance of the disease. In some of the sandy regions of northeastern Colorado, wheat was injured so badly by footrot that it was not harvested (PDR 22: 374). The disease was reported from Polk, Linn, Benton, and Marion Counties, Oregon, by Roderick Sprague (PDR 22: 174).

Scab (Gibberella zeae) was reported generally more prevalent this year than in 1937. Seventeen States reported losses as follows: Minnesota, 7 percent; Tennessee and Iowa, each 5; Virginia, 3; North Carolina, 2; New York, Maryland, Indiana, and Wisconsin, each 1; Pennsylvania, Kentucky, Arkansas, Ohio, Illinois, Michigan, North Dakota, and Kansas, each reported less than 1 percent.

Stripe rust (Puccinia glumarum): Wayne M. Bever, reporting from the Palouse Region of Idaho and adjacent areas, stated that stripe rust reached its maximum development about the middle of June, which was

approximately 3 weeks earlier than normal. The epidemic was the most severe he had ever observed. The extent of the epidemic in commercial wheat fields was not definitely known (PDR 22: 346, 372). In Washington, O. A. Vogel reported stripe rust appeared early in the spring and no doubt did some damage, particularly to the Forty-fold and Golden varieties. However, in spite of infections as high as 50 to 60 percent, these varieties produced a good crop (PDR 22: 346, 347). According to C. A. Suneson, stripe rust was found in most sections of California (PDR 22: 245).

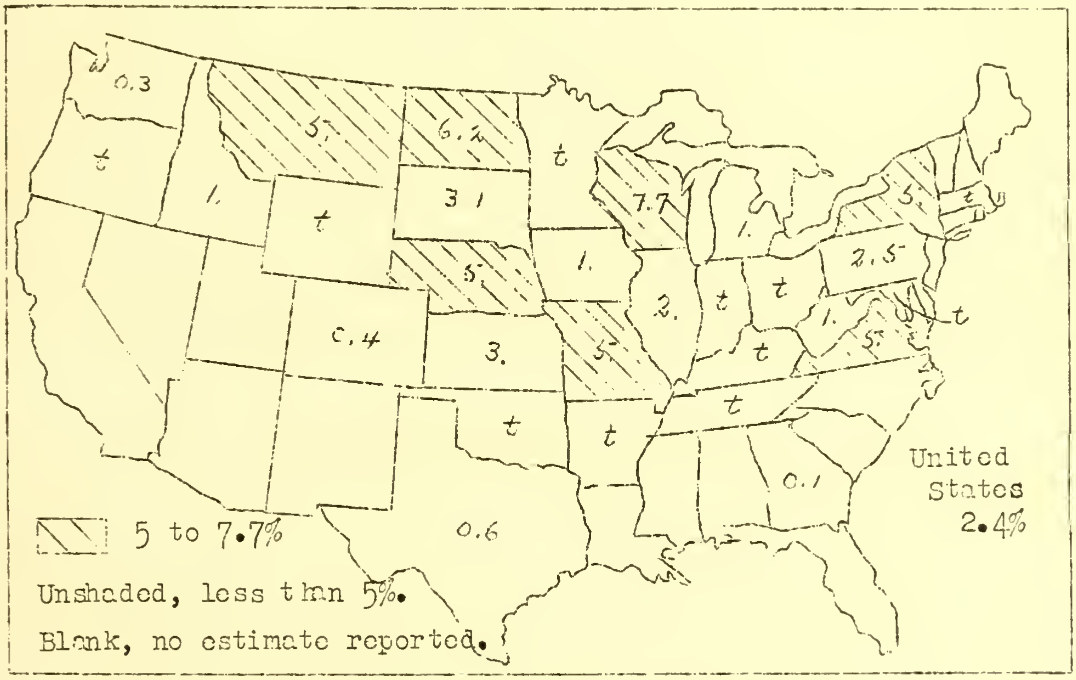

Fig. 22. Estimated percentage losses caused by stem rust of wheat in 1938.

Stem rust (Puccinia graminis tritici): The development of stem rust in the Central States has been summarized by E. C. Stakman and L. M. Hamilton in Supplement 117. In this area, although it caused significant losses, it was in general not nearly so destructive in 1938 as in 1935 and 1937 (Fig. 22). One unusual feature was the northwestward extension of heavy infection. Northward movement of infection was again evident, as in 1935 and 1937. Reports from the Southern Plains States all mentioned unusually early appearances this year of both leaf rust and stem rust on wheat. In Virginia, stem rust appeared earlier, developed

more rapidly, and caused more damage near rusted barberry bushes, according to G. E. Matheny. The early appearance of both stem rust and leaf rust this year in Virginia appeared to have been due largely to unusually favorable moisture and temperature conditions during the early part of the growing season (Suppl. 115). On May 18, with wheat almost mature, traces of stem rust appeared in all fields near Athens, Georgia, but too late to do any damage (PDR 22: 176). It also came too late in Ohio to cause appreciable damage. In North Dakota stem rust was prevalent throughout the State, especially on such susceptible varieties as Marquis, Ceres, and Reward. Thatcher rarely showed a severity of as much as 10 percent. Stem rust was light to severe on durum wheat, but of too late incidence to cause much damage (PDR 22: 369-371). The stem rust situation in Kansas is given by L. E. Melchers and C. O. Johnston in the Plant Disease Reporter, Supplement 116, "The wheat stem and leaf rust epidemics of 1938 in Kansas"; other reports may be found in Volume 22 of the Reporter. In Idaho some damage occurred in commercial fields near barberry bushes. Several barberry hedges near Colfax, Washington, were literally covered with aecia, and the low portions of wheat fields adjacent to them were heavily infected. By the first week in July telia were so prevalent that these fields appeared to be black (PDR 22: 347, 372). In California, according to C. A. Suneson, stem rust damaged wheat considerably in southern counties (PDR 22: 143, 245).

Leaf rust (Puccinia rubigo-vera tritici): From reports and observations, weather and crop conditions have seldom been so favorable for the development of a leaf-rust epidemic as they were in 1938. The extremely mild winter throughout the central and southern plains area favored abundant overwintering of the fungus in central and southern Texas, and an unusually early and rapid increase in the amount of inoculum. The Southern Plains States reported unusually early appearance of leaf rust, while Virginia, Illinois, North Dakota, Iowa, and Washington reported early appearance (PDR 22: 151). By April 20 extremely heavy infections were reported from central Oklahoma, an area that from that time onward produced vast amounts of inoculum for northern distribution (Suppl. 116). Judging from previous estimates and other records of the Plant Disease Survey, the 1938 leaf rust epiphytotic was the earliest, most extensive and severe ever recorded. The estimates of loss for this year are shown in Figure 23. For detailed reports on the disease, see index to the Reporter and the following supplements:

Chester, K. Starr. The 1938 wheat leaf-rust epiphytotic in Oklahoma. Supplement 112.

Matheny, G. E. A summary of the cereal-rust situation in Virginia in 1938. Supplement 115.

Johnston, C. O, and L. E. Melchers. Stem rust and leaf rust of wheat in Kansas in 1938. Supplement 116.

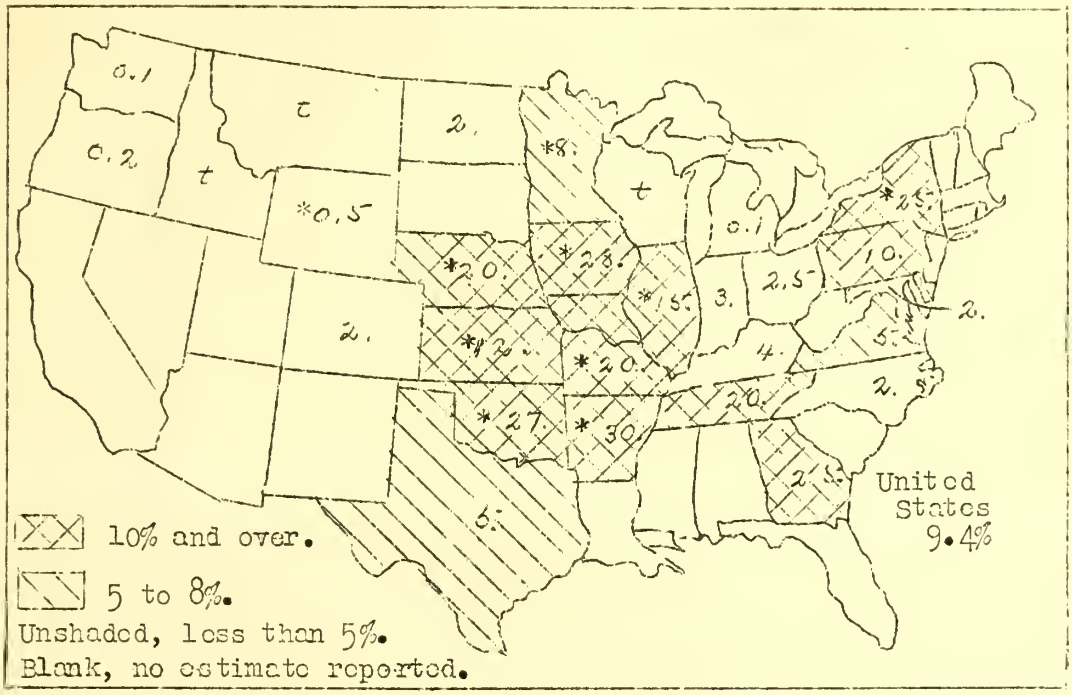

Fig. 23. Estimated percentage losses from leaf rust of wheat in 1938. (* = heaviest loss reported to the Survey from the State).

White foot rot and eye spot (Rhizoctonia sp.) was found May 10 in the Willamette Valley, Oregon, in Lake County. This is the first time it has been seen outside of the coastal region (PDR 22: 175).

Glume blotch (Septoria nodorum) was reported as causing much more damage this year than in 1937. New York reported 1 percent reduction in yield. Other States reporting the same amount were Maryland, Virginia, and Illinois. Pennsylvania and Kentucky reported 2 percent loss. Slight losses were reported from Arkansas, Ohio, Iowa, and Kansas (PDR 22: 241-242, 244). Head blight and glume blotch reported as due to Septoria and Alternaria caused 0.2 percent loss in Michigan. Septoria sp. was reported from Iowa and California (PDR 22: 143, 181, 207).

Speckled leaf blotch (Septoria tritici) caused about the same amount of damage as last year. Illinois reported 6 percent loss; New York and Virginia, 1 percent; elsewhere it was less. Occurrence was reported from Washington and Oregon (PDR 22: 174).

Bunt (*Tilletia levis* and *T. tritici*) was somewhat less prevalent than in 1937. It was reported from 24 States. States reporting losses of 1 percent or more were Colorado, 4.5 percent; New York, 3; Pennsylvania and Virginia, each 2.5; Oklahoma, Idaho, and Washington, each 2; Maryland, 1.5; North Carolina, Kentucky, Tennessee, Ohio, Michigan, Wisconsin, Iowa, Montana, Wyoming, and Oregon, each 1. A trace of "short smut" (*T. tritici*) was found near Winchester, Idaho. Near Mohler, Idaho, as much as 1 or 2 percent was found in some of the fields examined. This is much more than ever observed in this particular section and indicates that this form of smut is becoming more prevalent. It was found in Latah County for the first time this year, but failed to appear near Plummer, Idaho, where it was abundant in 1936 (PDR 22: 373). In Pennsylvania, R. S. Kirby reported the average infection in 109 untreated fields was 1.99 percent, and a trace was found in 3 out of 33 fields planted with treated seed.

According to Bert W. Whitlock, in 1937 the percentage of smutty wheat receipts at Columbia River, Puget Sound and Spokane Markets had dropped to about 8 percent from a high point of 36.6 percent in 1931. The August (1938) carlot inspections in Washington and Oregon showed that the percentage of the 1938 wheat crop that graded smutty was between 5 and 6 percent (PDR 23: 71-74). R. J. Haskell reported, "The percentage of carloads of smutty wheat received at Minneapolis has been steadily declining since 1930, when a high point was reach with 17.8 percent of all inspected receipts grading smutty. During 1937, only 1.6 percent were smutty and in September, 1938, which is a fairly good index for the year, the percentage was still further reduced to 1.1 percent"(PDR 23: 73-74). Kansas reported less in the State as a whole, but greater prevalence than usual in the southeastern counties.

Loose smut (*Ustilago tritici*): Judging from the 1938 crop loss estimates, loose smut was less prevalent than during 1937. M. F. Barrus and K. D. Butler from New York reported that Yorkwin, resistant variety, was replacing Honor, which is more susceptible (PDR 22: 300); in Pennsylvania, R. S. Kirby reported 1.66 percent reduction in yield in 135 fields planted with untreated seed. K. S. Chester from Oklahoma reported that the disease appears to be increasing annually. Losses of 1 percent or more estimated include 2.5 percent in Oklahoma; 2 percent in Maryland, Kentucky, Georgia, and Illinois; 1.7 in Pennsylvania; and 1 in Virginia, North Carolina, Arkansas, Indiana, and Iowa. Ten other States reported slight losses.

Basal glume blotch (*Bacterium atrofaciens*) in Illinois was reported by the Natural History Survey as more prevalent than last year or in an average year. Data taken in fields distributed in 15 counties showed 5.6 percent of heads with disease and an average of 0.65 percent of spikelets infected. In Kansas, according to C. O. Johnston, the disease was more prevalent in the eastern half of the State (PDR 22: 244, 245).

Black chaff (B. translucens undulosum) was reported as general and more prevalent in Virginia than for several previous years, loss was estimated at 1 percent; in Oklahoma, "One collection from Perkins," Payne County; a trace was reported from Arkansas, Ohio, Illinois, Michigan, Minnesota, North Dakota, and Iowa; in Kansas, C. O. Johnston and L. E. Melchers reported the disease severe in some localities in south central counties, and a trace in many counties over the State.

Wheat nematode (Anguina tritici) was more prevalent in Virginia than last year, according to G. E. Matheny. Estimated reduction in yield was 1 percent; South Carolina reported 15 percent of plants in one 6-acre field of wheat in Oconee County were found to be infected with this nematode (PDR 22: 337).

Mosaic (virus): In Oklahoma, K. S. Chester reported that a few isolated plants were found in one field. It was reported from 3 counties in Illinois--Macoupin, Coles, and Shelby, where it had not been found before. Kansas, "None observed."

Weather injuries: "Adverse weather brings most loss to wheat crop" (PDR 23: 84-85). Frost injury was reported from Oklahoma and Idaho. In Oklahoma, according to K. Starr Chester, the sub-freezing temperatures of the first week of April caused frost injury, which was a yield factor in some parts of the State, notably in the southwestern counties. The injury appeared to have been limited to Early Blackhull, the only variety which was approaching maturity at the time of the frost (Suppl. 112). In Idaho, Wayne M. Bever reported that in certain areas frost damage was very evident in the fall-sown wheats. The damage was most severe in the swales and valleys; however, farmers brought in samples collected from higher areas showing frost damage. The extent of damage was at least a trace (PDR 22: 373). Heat and drought injury in North Dakota was reported as causing a total loss of 10 percent. In Idaho, Wayne M. Bever reported that spring wheat in the vicinity of Moscow suffered considerably from lack of moisture in combination with high temperatures. It was estimated that the yields were reduced 15 to 20 percent (PDR 22: 373).

ZEA MAYS. FIELD CORN:

Ear and stalk rot (Diplodia spp.): Increase in prevalence of D. zeae over 1937 was reported in Indiana and Illinois. In the latter State, Benjamin Koehler wrote that damage from stalk rot to early-planted corn and early varieties was more severe than he had observed before in 18 years of experience with corn diseases (PDR 22: 375). The extremely high percentages of D. zeae obtained in platings of damaged kernels from carload lots of the 1938 crop originating from these 2 States were equalled only in 1933 during previous surveys, according to P. E. Hoppe (PDR 23: 145), who reported general increases over a wide area, "including all corn-shipping States east of the Mississippi River, and portions

of Iowa and Missouri east of the River." Losses reported by collaborators are 5 percent in Georgia; 2 in North Carolina and Illinois; 1.5 in Louisiana; 1 in Virginia, Ohio, Wisconsin, and Iowa; 0.7 in Indiana; 0.5 in Maryland; 0.2 in Massachusetts; 0.1 in Michigan; a trace in Pennsylvania. Root rot caused by this fungus was reported from New Hampshire.

Diplodia macrospora was reported in 1938 only from Oklahoma, where it caused a loss of 1 percent.

Ear rots caused by various organisms: Relative prevalence of corn ear rot fungi in the 1938 crop, as indicated by samples from carload lots of known origin, has been reported by P. E. Hoppe (PDR 23: 142-148). Incidence as shown by receipts at terminal markets was very low, according to Neil E. Stevens (PDR 23: 301-306). Collaborators also reported smaller losses, as a rule, than in 1937. Benjamin Koehler recorded the lowest amount of rot so far noted in his corn ear rot determinations at Urbana, Illinois, in which he measures losses rather than prevalence (PDR 23: 87). The various fungi concerned were reported as follows:

Aspergillus niger was reported specifically only from Oklahoma, where a loss of 1 percent was estimated. Hoppe reported that Aspergillus spp. were obtained from samples from all States included in his survey west of the Mississippi, and from Alabama.

Fusarium spp. were reported more generally than other organisms. Losses of 10 percent and 6 percent reported from Georgia and Louisiana were the highest noted for any of the ear rot fungi. Other estimates of loss from fusarium ear rot were 4 percent in Pennsylvania, 3 in Illinois, 1 in Virginia, Wisconsin, and Iowa; and smaller losses in other States reporting, including Massachusetts, Indiana, Minnesota, North Dakota, and Idaho. Fusarium moniliforme was reported specifically from North Carolina, Michigan, Minnesota, and Oklahoma.

Gibberella zeae (formerly reported as G. saubinetii) again caused small losses, according to reports even less than in 1937, the highest estimates being 1.5 percent in Wisconsin and 1 percent in Kentucky, and only slight loss in other States reporting,—Ohio, Michigan, Indiana, Illinois, and Iowa.

Nigrospora sphaerica was said to show increased prevalence in Indiana, Illinois, Wisconsin, and Iowa, the only States from which it was reported. Losses were small, the highest estimate being 2 percent in Iowa. According to Hoppe, this organism was of very minor importance in the 1938 samples.

Penicillium spp. were reported only from Illinois, Wisconsin, and Minnesota, by collaborators, but Hoppe obtained them from samples from most of the States included in his survey.

Rhizopus sp. was reported from Illinois.

Stalk rot caused by various fungi other than Diplodia was reported as normal in prevalence. Fusarium spp. were most often designated as causal organisms, and other fungi associated were not usually named. R. F. Poole reported that heavy infection of fodder and stalks by F. moniliforme resulted in heavy damage in some fields in North Carolina, especially in the eastern part of the State. Pythium butleri was reported from Texas.

Foot rot, root rot, seedling blight, caused by various fungi, were generally reported as of average prevalence. Fusarium spp. and Gibberella zeae were most widely reported of the individual organisms associated with the disease. Other fungi reported include Penicillium from Massachusetts, Virginia, Minnesota, and Oregon; Pythium sp. from Massachusetts and Virginia, and from Iowa where loss due to it was estimated at 6 percent; and an undetermined fungus which was said to cause a loss of 16 percent in Colorado.

Leaf blight (Helminthosporium turcicum) was reported as unusually prevalent in Illinois, and as locally severe in Virginia. Benjamin Koehler reported unusual amounts observed at a number of places in Illinois, from the extreme south of the State to the northern part. Losses reported were 2 percent in Virginia, 0.2 in Massachusetts, traces in Louisiana and Oregon (PDR 22: 301, 375).

Leaf spot or white blast (Helminthosporium sp., not H. turcicum): In Indiana, A. J. Ullstrup reported, "Inbred Pr was very susceptible. In some fields 100 percent of the plants were infected and most of the plants were killed. Fifty to 70 percent of the ears were rotted in many fields. On other lines and open-pollinated corn the disease was not economically important."

Smut (Ustilago zeae) was apparently somewhat less damaging generally than in 1937. In Montana, however, it was much more prevalent, according to H. E. Morris. Loss estimates of 1 percent or more are: 8 percent in Colorado; 6 in Iowa; 4 in Pennsylvania and Minnesota; 3 in Georgia, Oklahoma, and Wyoming; 2 in Massachusetts, Wisconsin, North Dakota, Kansas, North Carolina, Montana; 1.5 in Maryland; 1 in Connecticut, New York, Michigan, and Virginia.

Black bundle (Cephalosporium acremonium) was reported, with negligible losses, from Pennsylvania, Michigan, and Iowa, but probably occurred much more widely. Brown spot (Physoderma zeae-maydis) caused losses estimated at 1 percent in North Carolina, 0.5 percent in Georgia, and traces in Virginia, Louisiana, and Oklahoma. Rust (Puccinia sorghi) was widespread in occurrence but caused slight loss or none, as usual, the only estimates of more than a trace reported being 1 percent in North Carolina and 0.5 percent in Massachusetts and Georgia. Head smut, (Sorosporium reilianum) was reported from Idaho, Washington, and Oregon.

Bacterial wilt (Aplanobacter stewarti): An increase in prevalence of bacterial wilt on field corn was noted in some central States, including Ohio, Indiana, Illinois, and Iowa, and possibly Kentucky, according to W. D. Valleau, who reported, "What was considered to be wilt was prevalent in field corn, in hybrid corn, and was very severe in certain pure lines. We are not certain as to the cause." The disease was said to be unusually abundant in the central and southern parts of both Indiana and Illinois. Leaves only, not the stalks, became infected in Illinois, and in many fields the green leaf area was reduced as much as 25 percent, according to Benjamin Koehler. A. J. Ullstrup reported that in Indiana, "The reduction in leaf area lowered the vigor of the plants and augmented stalk rot. Some ears failed to mature." Losses reported as due to bacterial wilt were 5 percent in Ohio and Kentucky, 0.5 percent in Iowa, and traces in New York, Indiana, Maryland, and Virginia.

Mosaic (virus) was reported from Louisiana.

ZEA MAYS. POPCORN:

Ear rot caused by Aspergillus niger and Fusarium sp., and smut (Ustilago zeae) were reported from Illinois, and popped kernels (nonparasitic) from Washington.

ZEA MAYS. SWEET CORN:

Ear and stalk rot (Diplodia spp.) was less important this year than in 1937, judging from reports received by the Survey. Losses were estimated as follows: Iowa, 3 percent; Maryland, 2; Minnesota, 1; New York, 0.2; Ohio and Michigan, each 0.1; Oklahoma, Indiana, and Wisconsin, each a trace.

Seedling blight (Diplodia sp., Fusarium spp., etc.) was more prevalent than for several previous years in Massachusetts. It caused a total loss of 5 percent. Leaf blight (Helminthosporium turcicum): Losses amounting to a trace were reported from Massachusetts, Maryland, Oklahoma, Ohio, Michigan, Washington, and Oregon. Rust (Puccinia sorghi), as usual, was reported from many States, but was unimportant.

Smut (Ustilago zeae) was reported generally as causing less damage than last year. States reporting losses of 1 percent or more were Oklahoma and Colorado, each 10; Iowa, 8; Wisconsin, 6; Pennsylvania and Ohio, each 5; Minnesota and Wyoming, each 4; Massachusetts, New York, and North Dakota, each 3; Maryland and Montana, each 2; Connecticut and Michigan, each 1.

Bacterial wilt (Aplanobacter stewarti): Incidence of bacterial wilt of sweet corn in the northeastern States for 1938 is summarized by Charlotte Elliott (PDR 22: 401-402). A further summary of conditions in 1938 is given by Neil E. Stevens and C. M. Haenseler (PDR 23: 99-100). Of the 9 States reporting incidence of wilt, Maryland, Ohio, Indiana, and Iowa reported more than last year, and Connecticut reported less. Percentage losses were estimated as follows: Pennsylvania, 3; Ohio, 2.5; Indiana,

DISEASES OF FORAGE AND COVER CROPS

LEGUMES

MEDICAGO SATIVA. ALFALFA:

Black stem (Pleospora rehmiana [Ascochyta imperfecta, Phoma medicaginis]) was reported generally from Kansas, "causing marked defoliation of leaflets and marring of stems," according to D. B. Creager. It was reported by W. D. Valleau as being very destructive to alfalfa this year in all parts of Kentucky (PDR 22: 164). K. Starr Chester, writing from Oklahoma, said, "Reported from Kansas at our annual alfalfa meeting in 1938, and apparently quite widespread in Oklahoma."

Leaf spot (Cercospora medicaginis) was observed at Jerseyville, Jersey County, Illinois, on August 22, according to the Natural History Survey. In Iowa, I. E. Melhus reported it as causing 2 percent reduction in yield.

Powdery mildew (Erysiphe graminis) was reported from Wyoming, in Albany and Goshen Counties. The susceptible varieties were Common and Grimm. Root rot (Fusarium oxysporum medicaginis): Nebraska reported that root rot was found on alfalfa sown in the fall of 1937, on soil which had grown alfalfa for 8 years previous to 1936 (2 years in farm crops). Anthracnose (Gloeosporium medicaginis) was observed in Muskogee County, Oklahoma.

Downy mildew (Peronospora trifoliorum) was reported from New Jersey, Wisconsin, Kansas, and Washington. In Kansas the disease was "Fairly generally distributed on young growth (tops of plants) on 2 to 3 year old plants at Rifle Range." Leaf blotch (Placosphaeria medicaginis) was reported from Centralia, Marion County, Illinois, on April 29. Leaf spot (Phyllosticta medicaginis) was reported from Jerseyville, Jersey County, Illinois, on August 22. Slime mold (Physarum sp.) was observed locally in Pennsylvania.

Leaf spot (Pseudopeziza medicaginis) was reported by O. C. Boyd in Massachusetts as being more prevalent than last year and much more prevalent than in an average year, estimated total loss was 5 percent (PDR 22: 337-338); New Jersey, in Middlesex County; observed at Jerseyville, Jersey County, Illinois, on August 22; trace loss in Michigan; reported generally in Minnesota; Iowa, less prevalent than last year, 3 percent reduction in yield; usual amount reported from Wyoming, general in fields under irrigation, estimated total loss 1 percent; observed in Pierce, Lewis, and Clarke Counties, Washington.

Leaf spot (Pseudoplea briosiana): In Wisconsin, R. E. Vaughan reported the disease more prevalent than for several years owing to the wet weather, "Came on very bad after first cutting"; local distribution in Kansas, according to D. B. Creager the the disease was observed in one row at Rifle Range on one plant in particular, but had spread to adjacent plants in the same and nearby rows.

Blotch (Pyrenopeziza medicaginis) was reported more prevalent than in an average year in Kansas. Observed at Rifle Range and Agronomy Farm. Damping-off (Pythium debaryanum and P. ultimum) was reported from Riverside County, California. Violet root rot (Rhizoctonia crocorum): Texas, in Tom Green County. In Oklahoma, K. S. Chester reported a single collection, associated with heart rot. This is the first report to the Survey on this host from Oklahoma. Crown rot (Sclerotinia trifoliorum): W. D. Valleau reporting from Kentucky said, "Fall sown alfalfa (1937) was severely injured in the spring of 1938" (PDR 22: 117).

Rust (Uromyces striatus) was reported from New Jersey, and Texas in Pecos County; it was reported by Chester in Oklahoma as being very abundant in a field 3 miles north of Norman, and seriously injuring one crop. Found occasionally at other locations, but never in great abundance. Observed in Kansas July 7.

Bacterial wilt (Aplanobacter insidiosum) in Massachusetts, according to O. C. Boyd, was less prevalent than last year and much less than in an average year, estimated total loss was 5 percent. In New York, M. F. Barrus reported as follows: "The disease is localized, as yet, in the central part of State, but was found in past year in west central part. It was common in Madison County in 1938 and causing some concern," estimated loss was set at 0.5 percent. Chester in reporting from Oklahoma said the disease was "generally combined with heart rot and other injuries and troubles, producing a disease complex in urgent need of further study. Mineral deficiencies (minor elements) apparently involved in some cases." In Michigan J. H. Muncie reported bacterial wilt more prevalent than for several previous years, "Caused killing-out of many fields after second cutting, moved 100 miles north of 1937 limit." In Wisconsin, according to R. E. Vaughan, the disease was much more prevalent than last year, "Associated with root injury. Some evidence of root weevil although insects not proved." Minnesota and Iowa also reported it more prevalent than for several previous years. I. E. Melhus estimated 7 percent reduction in yield for Iowa. Kansas reported selections of Kansas Common and Turkestan in wilt nursery continued to show marked resistance to the disease. In Wyoming, G. H. Starr reported the usual prevalence, general in irrigated fields of Common and Grimm alfalfa, the resistant varieties were Hardistan, Turkestan, and Ladak; reported from Washington, in Okanogan County. Mosaic (virus): Washington, in Clarke County.

Leaf-hopper (yellows): In Wisconsin, R. E. Vaughan reported that damage was obscured by good growing conditions. Insects were earlier than ever before. Winter injury was much less important in Wisconsin than last year. North Dakota reported a total loss of 10 percent. Boron deficiency (yellowing): In North Carolina, according to R. F. Poole, small applications of boron have controlled yellowing on sandy soils.

MELILOTUS spp. SWEET CLOVER:

Stem blight (Ascochyta caulicola) in Kansas was reported by D. B. Creager as very severe in the seed increase nursery on a yellow-flowered variety. Many plants were killed, others badly distorted, and many defoliated. Dr. F. R. Jones of Wisconsin pointed out the trouble to him during the Alfalfa Conference. He observed the disease during August in Missouri, Illinois, Indiana, Ohio, and Pennsylvania.

Leaf spot and stem blight (Cercospora meliloti) was observed locally in Wisconsin, more prevalent than for several years. Root rot (Fusarium spp. and other fungi) was reported more prevalent in Minnesota, on white sweet clover, than last year or in an average year (PDR 22: 246). Phytophthora megasperma was reported more prevalent in Wisconsin. Sclerotinia minor was observed on white sweet clover in Minnesota, "Only one plant found, June 17."

SOJA MAX. SOYBEAN:

Leaf spot (Cercospora diazu) was observed at Falmouth, Jasper County, Illinois, September 24. Stem canker (Diaporthe sojae) was found in Illinois "In 4 fields, the percentages of diseased plants were 7.5 percent, 1 percent, 0.4 percent, and 9.2 percent." Stem blight (Glomerella glycines) was observed at Lovington, Moultrie County, Illinois, October 14. Downy mildew (Peronospora manshurica) in Illinois, according to the Natural History Survey, was "Observed in 3 fields; 85 percent (July 30), 100 percent (August 2), and 25 percent (August 6) of plants diseased." Charcoal rot (Sclerotium bataticola): Illinois reported the disease was found only in 2 fields. Southern wilt (Sclerotium rolfsii) was reported by L. R. Person in St. Landry and E. Baton Rouge Parishes, Louisiana.

Bacterial leaf spot (Bacterium glycineum) was reported by the Illinois Natural History Survey as follows: "Data taken in 2 fields show: 1-- 78.7 percent of plants infected, 54 spots per leaflet (July 30); 2-- 100 percent of plants infected, 86 spots per leaflet (September 24)." (PDR 22: 366). Bacterial pustule (Bacterium phaseoli sojense) was reported by S. B. Fenne as quite general throughout the Coastal Plain section of Georgia (PDR 22: 377).

Curly top (virus): Washington, in small experimental plots at Prosser. This is the first report on this host to the Survey. (PDR 23: 111). Mosaic (virus): New Jersey. Blast (undetermined): Oklahoma.

TRIFOLIUM spp. CLOVER:

Leaf spot (Cercospora zebrina) in Minnesota was observed on T. hybridum, less prevalent than for several years on T. pratense. It was reported from Illinois on T. pratense in 2 fields, both in St. Clair County, May 20 and October 8. Leaf spot (Macrosporium sarcinaeforme) was observed in St. Clair County, Illinois, October 8; in Wisconsin it was more prevalent than for several previous years, owing to the long rainy season. General distribution in Minnesota, according to L. Henson.

Anthracnose (Colletotrichum destructivum) was present in 4 counties in Minnesota. Powdery mildew (Erysiphe polygoni) was reported from Massachusetts, Illinois, Wisconsin, Minnesota, Iowa, and Washington. In Massachusetts, W. H. Davis reported the least seen in past 10 years. Anthracnose (Gloeosporium caulivorum) was reported by R. E. Vaughan as more prevalent than last year or in an average year. In Minnesota, L. Henson reported northern anthracnose on T. pratense widely distributed and causing considerable loss of first crop in June. Effect on winter injury unknown. Sooty spot (Phyllachora trifolii) was observed in New Jersey and Minnesota. Slime mold (Physarum sp.) occurred locally in Pennsylvania, according to R. S. Kirby.

Leaf spot (Pseudopeziza trifolii) caused severe infection in New Jersey; in Minnesota the disease was reported less prevalent than usual on T. pratense; in California, according to J. B. Kendrick and M. W. Gardner, it was observed on white and ladino clover.

Crown, stem, and root rot (Sclerotinia trifoliorum): Crown rot was reported from several sections of New Jersey. Stem rot of crimson clover was observed in Norfolk, Princess Anne, and Accomac Counties, Virginia (PDR 22: 91). In Kentucky, Valleau reported considerable damage to crimson clover stands in spring of 1938, but no loss because it is a cover crop. R. F. Poole reported root rot causing heavy losses in an isolated field, especially on crimson and red clovers. Leaf spot (Septoria trifolii) was prevalent but not severe in New Jersey.

Rust (Uromyces spp.): Washington, in Clarke County. U. fallens was reported generally throughout New Jersey. General distribution was observed in Minnesota on T. pratense, with the usual prevalence. U. trifolii was reported more prevalent in Wisconsin than last year or in an average year; also reported from Minnesota on T. repens and T. hybridum. From Massachusetts, W. H. Davis reported that for the first time in 10 years the 0, I stage of U. hybridi, U. trifolii, and U. trifolii repentis was not found. Least rust seen in last 16 years.

Bacterial leaf spot (Bacterium trifoliorum) in Minnesota, according to L. Henson, was reported about as prevalent as usual on T. pratense, scattered distribution on T. repens, and general distribution on T. hybridum. Mosaic (virus) was observed at Belleville, St. Clair County, Illinois, October 8. Usual prevalence reported on T. pratense in Minnesota.

VIGNA SINENSIS. COWPEA:

Leaf spot (Cercospora sp.) was reported severe in 2 plantings in New Jersey. Oklahoma reported the disease in Sequoyah, Garvin, and Payne Counties. Leaf spot (Colletotrichum lindemuthianum) was observed in Hughes County, Oklahoma. Leaf spot (Phyllosticta phaseolina) was observed at Tamaroa, Perry County, Illinois, July 30. Powdery mildew (Erysiphe sp.) was distributed generally in Oklahoma, according to K. S. Chester. Root rot (Phymatotrichum omnivorum): From Oklahoma, Chester reported as follows: "Severely attacked in the root rot area, where the peas are often used in soil improvement plans, sometimes voiding the value of gramineous rotations." The disease was also observed in Bell County, Texas. Root and stem rot (Pythium ultimum): California (PDR 22: 356). Rust (Uromyces phaseoli vignae): In Oklahoma, according to Chester, one field was fairly well infected in Berwyn. Not found elsewhere in the State, although many fields were examined. It was also observed in Lavaca County, Texas.

Bacterial spot (Bacterium vignae) is always quite prevalent in Oklahoma, according to K. S. Chester. Usual amount was present this year. Root knot (Heterodera marioni): In Oklahoma Chester reported, "Value of soil improvement plans often voided by interplanting corn with susceptible cowpeas." General distribution in the State. Mosaic (virus): According to Chester, in Oklahoma the disease was "Present in one station seed lot of 'New Era' from which it spread to other plots and produced 100 percent infection by end of season. Carried in 5 percent of the seed. Low order of mechanical transmissibility. Not found in 30 commercial seed lots from Oklahoma, nor in other fields." Crinkle mosaic (virus) was present in Cherokee County, Texas. Chlorosis (physiological): Texas.

GRASSES

Notes on diseases of grasses in Oregon and adjacent counties in Washington during the spring of 1938 are given in the Reporter 22: 174-175.

* = First report to the Plant Disease Survey.
** = First report from State to the Plant Disease Survey.

AGROPYRON spp. WHEATGRASS:

Claviceps purpurea, ergot, on A. Smithii was abundant in **Oklahoma, especially in the northeastern quarter of the State; cattle injury probably resulting (K. S. Chester). Ergot was reported on this same host from Nebraska, Kansas, and Wyoming. According to D. B. Creager, the disease "occurred in abundance on western wheatgrass in Animal Husbandry pasture, Kansas State College. Several cattle aborted." G. H. Starr reporting from Wyoming said, "Most ergot seen in recent years." He also reported ergot on A. pauciflorum and *A. spicatum. One report on *A. inerme from Whitman County, Washington.

The following diseases were reported by G. W. Fischer from Washington:

Erysiphe graminis, powdery mildew, on crested wheatgrass *A. cristatum, Whitman County; on beardless wheatgrass, **A. inerme, Soil Conservation Nurseries, Pullman, Whitman County; on slender wheatgrass, **A. pauciflorum, Pullman; on bluebunch wheatgrass, *A. spicatum, Soil Conservation Nurseries, Pullman.

Puccinia glumarum, stripe rust, on crested wheatgrass, A. cristatum, Whitman County, general; on beardless wheatgrass, *A. inerme, Whitman County, general; on slender wheatgrass, **A. pauciflorum, College Farm, Pullman; on *A. sibiricum, Soil Conservation Nurseries, Pullman; on western wheatgrass, **A. Smithii, College Farm, Pullman. P. graminis, stem rust, on slender wheatgrass, A. pauciflorum, Whitman County, general. P. pattersoniana, rust, on bluebunch wheatgrass, A. spicatum, Whitman and Klickitat Counties. P. rubigo-vera, leaf rust, on *A. elmeri, Soil Conservation Nurseries, Pullman.

Ustilago bullata, smut, on crested wheatgrass, A. cristatum, Whitman County; on thickspike wheatgrass, *A. dasystachyum, Soil Conservation Nurseries, Pullman; on beardless wheatgrass, A. inerme, Soil Conservation Nurseries, Pullman; on slender wheatgrass, *A. pauciflorum, College Farm, Pullman. General in Whitman County; on *A. lasianthum, Soil Conservation Nurseries, Pullman; on bearded wheatgrass, A. subsecundum, Soil Conservation Nurseries, Pullman. U. hordei, smut, on crested wheatgrass, A. cristatum, Soil Conservation Nurseries, Pullman. U. hypodytes, smut, on crested wheatgrass, A. cristatum, Whitman County, scattered; on slender wheatgrass, *A. pauciflorum, Whitman County; on quackgrass, **A. repens, Whitman County, very prevalent; on *A. sibiricum, A. Smithii, and *A. spicatum, Soil Conservation Nurseries, Pullman. U. striaeformis, smut, on beardless wheatgrass, A. inerme, Cheney, Spokane County. U. tritici, smut, on *A. sibiricum, Soil Conservation Nurseries, Pullman.

Hair-pin (undet.) on *A. cristatum, College Farm, Pullman; on *A. sibiricum, Soil Conservation Nurseries, Pullman; on *A. trichophorum, Pullman.

AGROSTIS ALBA. REDTOP:

Scolecotrichum graminis, leaf spot, was reported by the Natural History Survey from Woodlawn, Jefferson County, Illinois, June 9. Ustilago striaeformis, smut: Heavy infection was reported at Williams Lake, Washington. Blast: Woodlawn, Jefferson County, Illinois, June 9.

ANDROPOGON FURCATUS. BLUEJOINT TURKEYFOOT:

Sorosporium ellisii, head smut, was collected once in Pawhuska, Osage County, **Oklahoma.

ARISTIDA OLIGANTHA. PRAIRIE THREE-AWN:

Uromyces peckianus, rust, was collected once at Guthrie, Oklahoma.

ARRHENATHERUM ELATIUS. TALL OATGRASS:

Ustilago perennans, smut, was reported generally in Whitman County, Washington.

AVENA FATUA. WILD OAT:

Puccinia graminis, stem rust: Colfax, Whitman County, Washington.

*BECKMANNIA SYZIGACHNE. AMERICAN SLOUGHGRASS:

Scolecotrichum graminis, leaf spot, was severe at Johnson, Whitman County, Washington.

BOUTELOUA CURTIPENDULA. SIDE-OATS GRAMA:

Puccinia boutelouae, rust, in **Oklahoma, according to Chester, was evidently generally distributed. In **Kansas, D. B. Creager reported that a specimen had been sent in by Archie Hunter from Emporia to the Seed Laboratory.

BROMUS spp. BROMEGRASS:

Claviceps purpurea, ergot: In Wyoming, G. H. Starr reported the most ergot seen in recent years on **B. inermis and *B. marginatum. Erysiphe graminis, powdery mildew, on *B. carinatus at College Farm, Pullman, Washington. Septoria bromigena on B. inermis was reported from Lincoln, **Nebraska by R. W. Goss (PDR 22: 362); also reported from **Washington in Whitman County by G. W. Fischer. Tilletia guyotiana, smut, on *B. brizaeformis, Whitman County, Washington. Also reported on *B. mollis from Klickitat and Whitman Counties, Washington.

Ustilago bullata, smut, was reported from Washington as follows: on B. anomalus, B. inermis, and *B. macrostachys, Soil Conservation Nurseries, Pullman; on *B. erectus, College Farm, Pullman; on B. marginatus, Whitman, Spokane, and Klickitat Counties; on *B. mollis, from Whitman, Yakima, Klickitat, Spokane, and Franklin Counties; on B. tectorum, Whitman, Spokane, Stevens, Ferry, Okanogan, Chelan, Kittitas, Douglas, Lincoln, Adams, Grant, Franklin, Klickitat, Walla Walla, Garfield, Columbia, and Asotin Counties.

Hair-pin (undet.) was reported from College Farm, Pullman, Whitman County, Washington, on the following hosts: *B. brachystachys, *B. ciliatus, *B. inermis, *B. marginatus, *B. pacificus, *B. tectorum, and *B. vulgaris.

BUCHLOE DACTYLOIDES. BUFFALO GRASS:

Nematode reported as Anguillulina agrostis was observed in Payne and Woodward Counties, Oklahoma, according to K. S. Chester.

CALAMOVILFA LONGIFOLIA. SAND REED:

Puccinia amphigena, rust: Nebraska.

*CENCHRUS PAUCIFLORUS. FIELD SANDBUR:

Sorosporium syntherismae, smut, according to D. B. Creager, was collected by R. H. Painter in "Little Gobi Desert," 4 miles north of Garrison, Kansas.

CYNODON DACTYLON. BERMUDA GRASS:

Helminthosporium sp., leaf blight, in **Oklahoma, was "Especially evident on the clon known as 'African Bermuda' and associated with dying-out of lawns planted with this clon." Pythium sp., spot blight, in Oklahoma was "associated with Helminthosporium in dying out of lawns planted to the clon 'African Bermuda'." Rhizoctonia sp., root rot, was "associated with dying of lawn of 'African Bermuda' in Stillwater," **Oklahoma. R. solani was a common disease occurring in Louisiana, following wet periods during the summer months (PDR 22: 449). *Sclerospora graminicola, downy mildew, in Oklahoma was "abundant around Stillwater in weedy lawns during moist weather. Not seriously injurious and disappearing with dry summer weather." Ustilago cynodontis, smut, was common in local areas in Oklahoma, where it persists in the same spots from year to year, according to K. S. Chester. Also reported from Texas in Bell County.

DACTYLIS GLOMERATA. ORCHARD GRASS:

Claviceps purpurea, ergot: Montesano, Grays Harbor County, Washington. Colletotrichum graminicola, anthracnose, was observed at

Arlington Farm, **Virginia, on August 3 (PDR 22: 388). Also observed in the grass nursery at the U. S. Horticultural Station, Beltsville, **Maryland, on July 29, 1938. The fungus was present on all of the strains of orchard grass examined but appeared to be more prevalent on strains recently introduced from Europe (PDR 22: 388). Scolecotrichum graminis, leaf spot, was present in the grass nursery at the U. S. Horticultural Station, Beltsville, **Maryland on July 29, 1938, but caused less damage than the Colletotrichum during the season (PDR 22: 388).

DIGITARIA spp. CRABGRASS:

Fusarium sp., head mold, was observed on D. horizontalis in Henderson County, Texas. Piricularia leaf spot was reported on D. sanguinalis, causing a severe infection on border levees of affected fields. Infection no doubt spread from this grass to rice (PDR 22: 348).

ELYMUS spp. WILD-RYE:

Claviceps purpurea, ergot, reported on E. canadensis and *E. virginicus in Oklahoma was "collected frequently in the northeastern quarter of the State and was so abundant that some cattle injury probably resulted." **Wyoming, most ergot seen in recent years on E. macounii, according to G. H. Starr.

Epichloe typhina, cat-tail fungus, on E. canadensis, Soil Conservation Nurseries, Pullman, **Washington. Puccinia glumarum, stripe rust, on E. canadensis, College Farm, Pullman, Washington. P. condensatus, stem rust, on E. canadensis, Colfax, Whitman County, Washington. P. rubigo-vera agropyri, leaf rust, on E. condensatus, general, Whitman County, Washington. On E. glaucus, Oregon (PDR 22: 351). On E. triticoides, Soil Conservation Nurseries, Pullman, Whitman County, and Klickitat County, Washington.

Septoria elymi was found on the leaves of E. glaucus in the Peavy Arboretum, Benton County, Oregon. Ustilago bullata, smut, in Washington was reported on *E. canadensis from Whitman County; at the Soil Conservation Nurseries, Pullman, it was reported on *E. glaucus, E. junceus, and *E. sibiricus. U. hordei was also reported from the Soil Conservation Nurseries on *E. glaucus. U. hypodytes was observed at Endicott, Whitman County, on E. condensatus; also reported on E. glaucus and **E. sibiricus at the Soil Conservation Nurseries. U. striaeformis was reported from the Soil Conservation Nurseries on *E. sibiricus. Hair-pin (undet.) on E. condensatus at Endicott, Whitman County.

FESTUCA spp. FESCUE:

Corticium fuciforme, pink patch disease of turf, was observed for the first time in New Jersey during the past summer. It was more prevalent on the hard fescues in the rough and on the finer fescues of the fairway (PDR 22: 351).

The following diseases were reported from Washington:

Puccinia coronata, crown rust, on **F. idahoensis, F. ovina, and F. rubra, Soil Conservation Nurseries, Pullman. Ustilago bullata, smut, on F. idahoensis, Soil Conservation Nurseries, Pullman.

HORDEUM spp. BARLEY:

Puccinia glumarum, stripe rust: General in Whitman County, Washington, on H. nodosum. P. graminis, stem rust, on H. jubatum and H. murinum at Colfax, Whitman County, Washington. P. rubigo-vera, leaf rust, on H. nodosum, Whitman County, Washington. P. rubigo-vera similis on *H. pusillum in Kansas. Uromyces hordeinus heavily infected H. pusillum in Oklahoma (PDR 22: 207). It increased comparably with wheat leaf rust. Ustilago bullata, smut: General in Whitman County, Washington, on *H. nodosum.

LEPTOLOMA COGNATUM. FALL WITCHGRASS:

Puccinia imposita, rust, in Oklahoma was prevalent along roadsides over the State, according to K. S. Chester.

LOLIUM MULTIFLORUM. ITALIAN RYEGRASS:

Puccinia coronata, crown rust, heavily infected this grass in Oklahoma (PDR 22: 207).

ORYZOPSIS HYMENOIDES. INDIAN RICEGRASS:

Ustilago hypodytes, smut, was reported from Washington in the following counties: Spokane, Ferry, Okanogan, Douglas, Lincoln, Adams, Benton, and Franklin.

PANICUM SCRIBNERIANUM:

Dothichloe nigricans was reported from **Nebraska by R. W. Goss.

*PHALARIS ARUNDINACEA. REED CANARY GRASS:

Erysiphe graminis, powdery mildew, was observed at Pullman, Whitman County, Washington.

PHLEUM PRATENSE. TIMOTHY:

Phyllosticta phlei, leaf spot, was reported from Hope, Vermilion County, Illinois, June 28. Puccinia graminis, stem rust, was observed in New Jersey in Burlington and Middlesex Counties. Scolecotrichum graminis, leaf spot, was reported from Illinois as follows: Willow Hill, Jasper County, June 18; Lovington, Moultrie County, June 20. Ustilago striaeformis, smut: High Prairie, Washington; Willow Hill, Jasper County, Illinois, June 18.

POA spp. BLUEGRASS:

Erysiphe graminis, powdery mildew, on P. pratensis, Pullman, Whitman County, Washington. Helminthosporium sp., leaf spot: Nebraska and New Jersey on P. pratensis. Puccinia graminis, stem rust, on P. pratensis, Parkersburg, Richland County, Illinois, April 14. Puccinia poae-sudeticae was reported from Washington on *P. ampla from Pullman, also on P. nevadensis from the Soil Conservation Nurseries, Pullman; it was reported generally on P. pratensis in Whitman County, and very severe on **P. trivialis in the Soil Conservation Nurseries at Pullman. Ustilago striaeformis, smut, on P. pratensis, Williams Lake, Spokane County, Washington.

SITANION spp. SQUIRRELTAIL:

The following diseases were reported from Washington: Dilophospora alopecuri, twist disease, from Warwick on **S. jubatum; Puccinia glumarum, stripe rust, on S. hystrix, Soil Conservation Nurseries, Pullman; Urocystis agropyri, smut, from Warwick on S. jubatum; Ustilago sitanii, smut, on S. jubatum in Klickitat County.

SORGHASTRUM NUTANS. INDIAN GRASS:

Tolyposporella chrysopogonis, smut: Wichita, **Kansas.

SORGHUM HALEPENSE. JOHNSON GRASS:

Sphacelotheca cruenta, smut: Texas and California.

SORGHUM VULGARE SUDANENSE. SUDAN GRASS:

Colletotrichum graminicola, anthracnose, was observed at Arlington Farm, **Virginia, on August 3 (PDR 22: 388). Helminthosporium spp., leaf blight: New Jersey. H. turcicum, Brazos County, Texas. Sphacelotheca sorghi, smut: Puyallup, Pierce County, **Washington. Bacterium andropogoni, bacterial stripe: Brazos County, Texas.

STENOTAPHRUM SECUNDATUM. ST. AUGUSTINE GRASS:

Rhizoctonia solani, brown patch: Harris County, Texas.

STIPA COMATA. NEEDLE AND THREAD:

Puccinia stipae, rust: Soil Conservation Nurseries, Pullman, **Washington. Ustilago hypodytes, smut: Washington, in Ferry, Okanogan, Douglas, Lincoln, Adams, Benton, and Franklin Counties.

TRISETUM SPICATUM. SPIKE TRISETUM:

Puccinia monoica, rust: Soil Conservation Nurseries, Pullman, Washington.

DISEASES OF FRUIT CROPS

Fruit diseases on the Chicago market in 1938 were reported by G. B. Ramsey (Plant Disease Reporter Supplement 114, September 15, 1939).

AMYGDALUS PERSICA. PEACH:

Scab (Cladosporium carpophilum) was reported by O. C. Boyd as being more prevalent than for several years in Massachusetts, estimated loss 1.5 percent; also more prevalent in Connecticut; New York, "Severely infected peach twigs were received from Tousey, Orange County, 5 of 200 trees sprouted out lower on the trunk. Unsprayed Hale and Belle of Georgia. Abundant in Nassau County"; New Jersey, "General in south Jersey"; Pennsylvania, 3 percent loss: the disease in Maryland, according to R. A. Jehle, was more prevalent than last year or in an average year, estimated total loss 3 percent; in northern Virginia A. B. Groves reported it less prevalent than for several years, estimated loss a trace; West Virginia, 0.5 percent loss; Tennessee, no loss reported; North Carolina, 1 percent; Georgia, 1 percent; Texas, reported from four counties, estimated loss a trace; Oklahoma, generally prevalent; Ohio, 2 percent loss; in Indiana, R. C. Baines reported the usual prevalence, and estimated the loss a trace; Illinois, more prevalent than for several years, owing to the wet weather after the middle of May, 2 percent loss in grade and in storage, "Counts made in 37 orchards showed 47.4 percent of trees bearing infected fruit and 12.1 percent of all fruit infected"; in Michigan the disease was less prevalent than last year or in an average year, loss a trace, "Generally controlled by sulphur sprays"; Iowa, less prevalent than for several years, no loss was reported; Kansas, more prevalent than last year, but less prevalent than in an average year; in Idaho no loss was reported.

Blight (Coryneum beijerinckii) occurred in Ohio, trace loss; more prevalent in Michigan, owing to the rains during the late dormant period, D. Cation reported "severe loss in one orchard at Sparta, but not found in the main peach districts of Berrien, Van Buren, and Allegan Counties, loss estimated at a trace"; Idaho, more prevalent than last year, estimated loss 1 percent; Washington, reported from 5 counties, estimated loss a trace.

Powdery mildew (reported as Podosphaera oxyacanthae) was observed in Atlantic and Middlesex Counties, New Jersey.

Root rot (Polyporus curtisii), according to R. F. Poole, is well distributed in the sandhills of North Carolina, where it causes much dying of twigs and of trees. The fungus fruits from May to November.

Brown rot (Sclerotinia fructicola): Massachusetts, more prevalent than last year, 2 percent loss was estimated; Connecticut, more prevalent than in an average year, estimated loss 10 percent; New York, about the

same as usual, 1 percent loss; Pennsylvania, 10 percent loss; New Jersey, "Red Bird susceptible in south Jersey. Disease severe in some orchards and also the cause of great losses"; Maryland, less prevalent than last year, reduction in yield estimated at 0.5 percent, with an additional loss in grade and transit of 3 percent; Virginia, same loss as last year, 4 percent; reported by Sherwood from West Virginia as causing an estimated loss of 2 percent, more prevalent than for several years. "Moisture and temperature conditions very favorable to disease in early part of infection period, but disease checked by dry weather"; North Carolina, 8 percent loss; Tennessee, 20 percent; Georgia, 5 percent; Texas, reported from Leon, Dallas, and Cherokee Counties; Oklahoma, 3 percent loss; Arkansas (PDR 23: 8); Ohio, 5 percent; Indiana, 0.5 percent, usual prevalence; Illinois, less prevalent than in an average year, total estimated loss 5 percent. "Data taken in 101 orchards show 56.1 percent of trees with disease, 1 percent of twigs blighted, and 1.7 percent of fruit infected"; Michigan, "More prevalent than for several years owing to rains during last month before ripening, estimated reduction in yield 10 percent"; Iowa, more prevalent than last year or in an average year, estimated reduction in yield 3 percent; Nebraska, more prevalent than last year owing to early rains; Kansas, less prevalent than in an average year; Washington reported both _S. fructicola_ and _S. laxa_ in King, Pierce, and Clarke Counties.

Powdery mildew (_Sphaerotheca pannosa_) was reported from Massachusetts, New York, Maryland, and Virginia, as causing a trace loss; Idaho, no loss.

Leaf curl (_Taphrina deformans_) caused greater losses this year than last. In Massachusetts and New York the disease was generally distributed and more prevalent than for several years, estimated losses 1 percent (PDR 22: 202); New Jersey, "Severe in several orchards in south Jersey"; Pennsylvania, estimated loss 1.5 percent; Maryland, more prevalent than in an average year, estimated reduction in yield 3 percent; Virginia, same as last year, 1 percent loss; West Virginia, 0.5 percent loss; Kentucky, severe except where trees have been sprayed (PDR 22: 117); Tennessee, 0.5 percent loss; North Carolina, 0.5 percent loss; Georgia, 1 percent loss; Texas, trace; Oklahoma, 3.5 percent; Ohio, 1 percent; Indiana, trace; Illinois, less prevalent than last year or in an average year owing to the dry weather during latter part of April and first of May, no reduction in yield, "In 78 orchards an average of 35.7 percent of trees diseased, and 1.8 percent of leaves infected. Highest percentage was 100 percent of trees and 53 percent of leaves (White County)" (PDR 22: 186, 199-201); Michigan, "Infection occurred after growth had started, majority of orchards protected by sprays." Less than in an average year; in Iowa, G. C. Kent reported the disease more prevalent than for several years, estimated reduction in yield 5 percent; Idaho, less prevalent than last year, total loss a trace (PDR 22: 151); Washington, reported from Jefferson, Kitsap, Snohomish, King, Pierce, and Clarke Counties, estimated loss 0.3 percent.

Rust (Tranzschelia pruni-spinosae), in Massachusetts, caused an estimated loss of 0.1 percent; Florida (PDR 23: 40); Texas, estimated loss 0.5 percent; Oklahoma, trace; in Arkansas, J. C. Dunegan reported the disease more prevalent than last year or in an average year, "Data applies only to northwest Arkansas orchards, where fungus was noted during September on peach leaves. Many teliospores formed. No data for condition in commercial peach orchards in southwest portion of the State" (PDR 23: 8); Illinois, more prevalent than for several years, estimated reduction in yield a trace. "Distribution only in south, 33 percent of trees diseased and bearing 12 to 13 rust pustules per leaf, as averages."

Valsa canker (Valsa sp.): New York.

Wilt (Verticillium albo-atrum): New York, in Dutchess, Rockland, and Niagara Counties, total estimated loss a trace.

Bacterial spot (Bacterium pruni) was observed in New Hampshire; Massachusetts, 0.1 percent loss; Connecticut, much more prevalent than last year or in an average year, general distribution, estimated loss 10 percent; New York, scattered distribution, common in most peach orchards in Suffolk County, estimated loss a trace; Pennsylvania, trace loss; occurred in about the usual prevalence in Maryland, causing an estimated total loss of 2 percent; in Virginia the estimated loss was a trace; in Kentucky, according to W. D. Valleau, "Considerable defoliation occurred, which growers attributed to B. pruni, but much of it appeared to be due to nitrogen starvation because of high soil moisture content"; in North Carolina the reduction in yield was set at 1 percent; in Georgia 10 percent was recorded; Texas, trace; in Oklahoma the disease was much more prevalent than in 1937 or in an average year. K. S. Chester writes, "Our most important stone-fruit disease," estimated reduction in yield 4 percent; according to J. C. Dunegan, the disease was very prevalent on leaves of trees in northwestern Arkansas, but there was no fruit, due to freeze (PDR 23: 8); Ohio, reduction in yield 0.5 percent; Indiana, distribution scattered, more prevalent than for several years, total estimated loss 0.5 percent; H. W. Anderson reported from Illinois, "Worst epidemic in 20 years. The disease was much more prevalent than in 1937 or in an average year owing to the wet weather after the middle of May. The most susceptible varieties were J. H. Hale and Elberta," total estimated loss 10 percent. "Data taken in 37 orchards show 88.8 percent of trees and 17.4 percent of fruit infected, and 1.8 percent of leaf area destroyed" (PDR 22: 367); Michigan, "First appearance on peaches since 1931. Frequently present on young plantings several years old. Much rain after fruit had formed." Estimated total loss was set at 2 percent; Iowa reported a trace as total estimated loss.

Crown gall (Bacterium tumefaciens) was reported from 4 counties in Texas; and from Washington in Okanogan County.

Root knot (<u>Heterodera marioni</u>): In North Carolina, R. F. Poole reports, "This disease is prevalent in the sandhill areas, where it causes serious losses and kills young trees. Heavy fertilization has been of some value in reducing losses and establishing growth on infested soils"; reported from Texas in Tarrant and Anderson Counties; the disease in Oklahoma was "often very destructive, especially in sandy soils and bottoms. Experiments on heat treatments for control conducted in 1938."

Virus diseases: Little peach in New York was reported by W. D. Mills as causing an estimated loss of a trace, it was observed in the lower Hudson Valley and in Orleans and Wyoming Counties; it was also observed in Michigan. Mosaic was reported from Oklahoma as follows by K. S. Chester: "First discovered in Oklahoma in 1937. In 1938 a survey was conducted in Bryan County by the Federal Bureau of Entomology and Plant Quarantine. About 50 trees in the county were condemned for mosaic and destroyed"; it was observed in Colorado, causing 1 percent loss (PDR 23: 40). Phony peach in Georgia caused a loss of 5 percent; Oklahoma, trace; Illinois, "None found in 1938." Rosette was observed in Massachusetts as causing 0.1 percent loss; Illinois, "Examinations in 11 orchards (11,000 trees), none found"; it was also observed in Berrien County, Michigan. Yellow-red virosis (X-disease) was reported for the first time in Massachusetts from Worcester and Middlesex Counties (PDR 22: 334); more prevalent in Connecticut than for several years, it caused 50 to 75 percent loss in infected orchards, estimated reduction in yield for the State was set at 2 percent; in New York, according to E. M. Hildebrand and D. H. Palmiter, the disease has apparently become well established in several counties in the Hudson River Valley, diseased peach orchards have definitely been observed in three counties--Columbia, Greene, and Dutchess--and are apparently present also in two others--Rensselaer and Albany (for map showing a rough approximation of the known occurrence (1938) on peach and chokecherry see PDR 22: 395), the disease was reported from New York for the first time this year (PDR 22: 257, 268, 394-396). Yellows in Massachusetts was more prevalent than for several years, estimated total loss 2 percent; New York, "Less reports but prevalence believed the same," a trace was the estimated loss; New Jersey, "Prevalent in several orchards throughout the State, several trees have died"; Pennsylvania, K. W. Lauer states that of a total of 447,597 peach trees inspected in six counties, 501, or .111 percent, were found to be affected with yellows (PDR 22: 463); Maryland, scattered distribution, estimated reduction in yield 0.5 percent; Virginia, trace; in Tennessee the disease was found to be distributed over a much wider area and included counties in which it was not found last year (PDR 22: 387); Oklahoma and Ohio, trace; Illinois, "5 diseased trees found"; Michigan, less than usual, estimated loss a trace.

Spray injury (arsenical) has been experienced in Massachusetts where the zinc-lime corrective was omitted; more prevalent than usual in Connecticut owing to excess rain after spraying with arsenate of lead;

New York, much less prevalent than last year; Michigan, more prevalent than for several years owing to wet weather following sprays, "Severe losses where lime alone was used as a corrective. Injury checked by use of zinc-sulphate," estimated reduction in yield 2 percent.

Weather injuries: Frost injury was reported in New York from 7 counties, loss a trace; 15 percent loss was noted in Virginia; in West Virginia, Sherwood reported, "Total destruction of crop in less important regions of the State, moderate injury in eastern region," reduction in yield was estimated at 25 percent; in Kentucky the "New Haven variety of peach was the only one that survived the frosts of April 3 and 10. A few seedlings survived," estimated loss 75 percent (PDR 22: 164); in North Carolina frost caused 1 percent loss; Georgia, 5 percent; it caused much more damage in Michigan than last year, "Crop found only in favored locations on high ground," estimated reduction in yield 40 percent. Winter injury was reported from the following States, with losses as indicated; North Carolina, 1 percent; Georgia, 2; Washington, 5. Drought losses were estimated as follows: West Virginia, 5 percent; North Carolina, 1; Georgia, 2.

AMYGDALUS PERSICA NECTARINA. NECTARINE:

Powdery mildew (Podosphaera oxyacanthae) was reported from Cowlitz County, Washington, by the Department of Plant Pathology at Washington State College. This is the first report of powdery mildew on this host from Washington. The disease does not seem to be common on nectarine.

Brown rot (Sclerotinia sp.) was observed in Cowlitz County, Washington.

ANANAS SATIVUS. PINEAPPLE:

Black rot (Thielaviopsis paradoxa) continued to cause irregular losses ranging from 3 to 5 percent in pineapples from Puerto Rico. About the same percentage was found in Cuban pineapples except for arrivals during two weeks in mid-June when between 35 and 50 percent of the fruits were affected (PDR 22: 193, 407).

APPLE. See MALUS SYLVESTRIS.
APRICOT. See PRUNUS ARMENIACA.
AVOCADO. See PERSEA AMERICANA.
BLACKBERRY. See RUBUS sp.
BLUEBERRY. See VACCINIUM spp.
BOYSENBERRY. See RUBUS spp.

CARICA PAPAYA. PAPAYA:

Ripe rot (Colletotrichum gloeosporioides) was reported from Florida (PDR 23: 40); also reported from Puerto Rico as anthracnose.

Wilt (*Fusarium* sp.): Texas.

Stem rot (*Rhizoctonia* sp.): Puerto Rico.

Root rot (*Sclerotium rolfsii*): Puerto Rico.

"Rust" (*Pucciniopsis caricae*) was observed in Florida (PDR 23: 40).

CHERRY. See PRUNUS sp.
CHINESE JUJUBE. See ZIZYPHUS JUJUBA.

CITRUS spp. CITRUS:

See Plant Disease Reporter 23: 38-40 for a report on fruit diseases in Dade County, Florida, in 1938, by George D. Ruehle; P.D.R. 22: 190-193, for a report of fruit diseases on the New York Market during January, February, March, and April, 1938, by James S. Wiant and C. O. Bratley; P.D.R. 22: 404-408, for a report of fruit diseases on the New York Market during the months from May to September, 1938, inclusive, by C. O. Bratley and James S. Wiant.

Canker (*Bacterium citri*): During 1938 only one new case of citrus canker was found in Texas--there were six recurrent cases (PDR 23: 41).

CRANBERRY. See VACCINIUM MACROCARPON.

CYDONIA OBLONGA. QUINCE:

Leaf blight (*Fabraea maculata*) was observed in New York in four counties; Illinois, in Richland County.

Brooks spot (*Mycosphaerella pomi*): Massachusetts, the unusual rainfall favored this disease, it is even more pronounced this year than usual (PDR 22: 449).

Northwestern anthracnose (*Neofabraea malicorticis*): Washington, in Whitman County.

Black rot (*Physalospora obtusa*) was reported as less prevalent than in an average year in Massachusetts.

Blight (*Bacillus amylovorus*) in Massachusetts was reported more prevalent than usual, total estimated loss 1 percent; usual prevalence reported in New York; New Jersey, in Middlesex, Monmouth, Morris, Passaic, and Union Counties.

Crowngall (*Bacterium tumefaciens*): New Jersey.

Frost injury: In Massachusetts, "frost in spots destroyed blossoms, 0 to 50 percent."

DEWBERRY. See RUBUS sp.

FICUS CARICA. FIG:

Rust (Cerotelium fici): Texas, in Brazos and Dallas Counties.

Thread blight (Corticium stevensii) in Louisiana was more destructive than last year or in an average year, according to P. J. Mills.

Rust (Physopella fici) was present in Florida (PDR 23: 40); it was also observed in Louisiana in about the same amount as last year.

FIG. See FICUS CARICA.

FRAGARIA sp. STRAWBERRY:

Gray-mold rot (Botrytis cinerea) was more prevalent in Massachusetts than in an average year, owing to the wet weather in June and July, estimated reduction in yield was reported as 2 percent; in New York the estimated reduction in yield was 1 percent; Pennsylvania, 0.5 percent; Ohio, trace; Maryland, more prevalent than last year, 3 percent estimated reduction in yield plus 2 percent loss in grade; North Carolina, estimated reduction in yield 1 percent; Louisiana, 5 percent; in Arkansas, V. H. Young reported, "Much loss early in season when weather was cool and rainy"; Idaho, 1 percent loss.

Leaf spot (Cercospora sp.): Louisiana.

Leaf blight (Dendrophoma obscurans) was observed in Texas in San Jacinto County.

Leaf scorch (Diplocarpon earliana) in New York was more prevalent than for several years owing to high temperatures in late summer, a trace was the estimated reduction in yield; Pennsylvania, less prevalent than for several previous years, estimated loss 0.3 percent; the disease in Maryland was less prevalent than in an average year, estimated reduction in yield 1 percent; Virginia, estimated reduction in yield 2 percent; North Carolina, 7 percent; Tennessee, trace; Louisiana, usual prevalence, estimated loss 3 percent; Oklahoma, 1 percent loss; Arkansas, more prevalent than for several previous years, "Noted in severe form on Klondyke variety causing much defoliation. At University Farm gains from spraying indicated a local reduction in yield of 50 percent", loss over State estimated at 1 percent; Indiana, trace; Michigan, trace; Wisconsin, usual prevalence, most susceptible variety was Red Heart, estimated reduction in yield 1 percent; Idaho, trace.

Root rot (Fusarium orthoceras longius) in Maryland was less prevalent than last year or in an average year, according to R. A. Jehle, estimated total loss 3 percent.

Leaf spot (Mycosphaerella fragariae) appeared as follows: Vermont, estimated total loss 5 percent; the disease in Massachusetts was more damaging this year than last, also much more than in an average year, total estimated loss 2 percent, "Even Premier showed slight to moderate spotting this year" (O. C. Boyd); New York estimated a trace loss; New Jersey, "Not very serious"; Pennsylvania, less prevalent than for several previous years, estimated reduction in yield 0.9 percent, the Premier variety was reported immune; Maryland, more prevalent than in an average year, estimated total loss 2 percent; Virginia, general distribution, estimated reduction in yield 5 percent, according to S. A. Wingard, "there is always severe leaf spotting"; in North Carolina, "This disease caused heavy loss--good control was obtained by spraying with Bordeaux mixture. The loss was estimated at 15 percent"; Tennessee, 1 percent loss; Louisiana, usual prevalence, loss 10 percent; Arkansas, "Leaf spot appeared to be of minor importance"; Oklahoma, "Common but not very destructive," 3 percent loss; Ohio, estimated loss 0.5 percent; Indiana and Michigan estimated traces; Wisconsin, general distribution, more prevalent than last year, 0.5 percent was the estimated reduction in yield; Minnesota, general distribution, more prevalent than last year or in an average year owing to "plenty of rain in the early part of the season," estimated total loss 3 percent; Iowa, as prevalent as last year, distribution general, total estimated loss 3 percent; North Dakota, trace; Nebraska, more prevalent than in an average year, general over State, "Many spots in plantings but little injury resulting. Widespread --coextensive with host"; Kansas, same as last year but less than in an average year; Idaho, less than for several previous years, estimated loss a trace, "Very severe locally but not generally"; Washington.

Tan rot (Pezizella lythri) in Louisiana was less prevalent than last year, estimated loss 3 percent.

Leather rot (Phytophthora cactorum) was generally distributed in Louisiana, but less prevalent than last year.

Red stele (Phytophthora sp.): Maryland, distribution local, estimated total loss a trace (PDR 22: 108); in Virginia Harold T. Cook reported, "So far found only in Accomac County. One specimen sent in from Norfolk County," estimated reduction in yield 5 percent, maximum infection in any one field 100 percent; the disease in Delaware caused heavy losses among Lupton and Blakemore varieties in several fields, according to K. J. Kadow (PDR 22: 184-185); in Indiana, "During May, strawberry plants, Premier variety, infected with red stele root rot were found in two distantly separated fields in the southern part of the State" (PDR 22: 336); the disease if present is "not recognized in Wisconsin," according to R. E. Vaughan.

Fruit rot (Rhizopus nigricans): Illinois reported the same as last year, but less prevalent than in an average year.

Crown rot (Sclerotinia sclerotiorum): Iowa, trace.

Powdery mildew (Sphaerotheca humuli) was as prevalent as usual in New York, estimated loss a trace.

Black root rot (various causes): Fifteen States reported this group of root injuries with causes assigned as indicated: Massachusetts, undetermined, general prevalence, less than in an average year, total loss 5 percent; New York, poor drainage, local distribution; New Jersey, Pythium sp. and Rhizoctonia sp.; Pennsylvania, several fungi, less prevalent than for several previous years, estimated total loss 10 percent; Delaware (PDR 22: 185); Maryland, estimated loss 3 percent; Virginia, cause unknown--scattered distribution, estimated loss 5 percent, "This root rot is important in Virginia. I feel that it is associated with winter injury" (S. A. Wingard); Tennessee, 2 percent loss; Michigan, 10 percent loss; Wisconsin, low temperature, less prevalent than for several years, estimated loss 5 percent, "Proper mulching before temperature goes below 18° F. satisfactory for control" (R. E. Vaughan); Minnesota, less prevalent than last year, estimated reduction in yield 4 percent; Indiana, "Fusaria, caused a serious loss in one field" (PDR 22: 336); Iowa, cause unknown, less than in an average year, no loss reported; Nebraska, cause unknown; Washington, winter injury and fungi, reported from six counties.

Dwarf or crimp (Aphelenchoides fragariae) in Massachusetts was more prevalent than last year and much more prevalent than in an average year, estimated reduction in yield was 3 percent, plus 2 percent loss in grade (PDR 22: 269-271); in a survey reported by George M. Darrow and J. B. Demaree, the disease was found in Delaware, New Jersey, Maryland, and Virginia (PDR 22: 109); the disease in Virginia was more prevalent than for several previous years owing to the frequent and heavy rains, total loss was estimated at 2 percent; North Carolina, estimated reduction in yield 3 percent; Louisiana, less prevalent than last year, loss 0.1 percent; Arkansas, "Present in small amounts in many plantings. Chiefly important to plant growers, causes very little yield reduction in Arkansas."

Root knot (Heterodera marioni) in Maryland was observed as causing a trace loss; Texas, in Dimmit County.

Diseases reported as due to virus, under the following names: Crinkle was reported from Massachusetts, causing 1 percent reduction in yield; it appeared in Washington, in Spokane and Denton Counties. Mosaic caused a trace loss in Massachusetts; scattered distribution in Wisconsin, prevalence same as in an average year, "Adequate information lacking"; yellow edge was observed in Marion County, Illinois. Yellows: Nebraska. Xanthosis was observed in Massachusetts and New York as causing a trace loss; Ohio, 1.5 percent; Montana reported 5 percent estimated loss.

Variegation (cause undetermined), also known as "suspected mosaic," June yellows, Blakemore yellows, yellow leaf, was reported from Delaware in many fields; Maryland, scattered distribution, more prevalent than in an average year, estimated reduction in yield 1 percent; Kentucky, "Considerable complaint, present in most Blakemore plantings. Stable strains being introduced" (W. D. Valleau); North Carolina, 2 percent loss; Oklahoma, "About 4 percent of an experimental bed in Stillwater," (Payne County); Arkansas, "Very abundant owing to a large number of low-grade plants from Tennessee being brought into State in spring of 1937, often 15-25 percent seen" (V. H. Young), estimated loss 2 percent; Minnesota, "Still prevalent in fields of Blakemore"; Idaho, trace (PDR 22: 432).

Weather injury: Estimated reduction in yield from drought and heat injury is reported as follows: Vermont, 20 percent; Massachusetts, trace; North Carolina, 3 percent; Arkansas, "Stands reduced for present year by dry weather of last August and September"; Wisconsin and Montana, no loss; Idaho and Washington, traces of loss. Frost injury was reported from 5 counties in New York, estimated loss for the State 7 percent; Arkansas reported 20 percent loss, "Frosts on April 2, 9, and 10 destroyed blooms"; Ohio, 40 percent; and Indiana, 10 percent. Winter injury caused 2 percent loss in yield in Massachusetts; it was observed in New York, caused by slow drainage in low places in strawberry plantings; Michigan, Minnesota, and Montana each reported traces of loss; North Dakota, 1 percent; and Washington, 5 percent.

GOOSEBERRY. See RIBES GROSSULARIAE.
GRAPE. See VITIS spp.
GUAVA. See PSIDIUM GUAJAVA.
LOGAN RASPBERRY. See RUBUS spp.

LUCUMA NERVOSA. TI-ES:

Fruit spot (*Colletotrichum* sp., probably *C. gloeosporioides*) was observed on ti-es in Florida (PDR 23: 40).

Rust (*Uredo lucumae*) was more abundant and destructive on ti-es than in 1937 (PDR 23: 40).

MALUS SYLVESTRIS. APPLE:

Leaf spot (*Alternaria mali*) was reported from Monroe County, New York, "Fruiting bodies on leaf spots or burned areas," no loss.

Root rot (*Armillaria mellea*) appeared in Morris County, Texas.

Storage rot (*Botrytis* sp.) in Massachusetts was more prevalent than for several previous years; K. J. Kadow reported that "Gray mold rot was much more prevalent in Delaware than had been thought. It was found in practically all stored apples examined, although losses were serious in only a few cases" (PDR 22: 102, 117).

Sooty blotch (Gloeodes pomigena) was reported as more prevalent than in 1937 and much more prevalent than in an average year in New York, total loss a trace; New Jersey, "Reported from Monmouth, Mercer, Hunterdon, and Union Counties, also from south Jersey, more common than usual"; Pennsylvania; Oklahoma, in Haskell, Payne, and Cleveland Counties; Illinois, more prevalent than for several previous years owing to frequent rainy periods during the summer months, "Average in orchards examined 81.4 percent of trees, 23.1 percent of fruit infected. Some trouble was reported where orchards were in low areas, especially where the nicotine schedule had been substituted for lead arsenate in the late season."

Perennial canker (Gloeosporium perennans) was observed in Idaho as causing a trace loss (PDR 22: 151); Washington, in Columbia County.

Bitter rot (Glomerella cingulata) was reported as being more prevalent in Massachusetts than in 1937 and much more prevalent than in an average year, estimated total loss 0.5 percent; New York, more prevalent than for several previous years, W. D. Mills reported, "Worst case in Orange County reported September 3, 50 percent of McIntosh and Rhode Island Greening rotting in one orchard receiving only delayed dormant and calyx sprays. Specimens identified from Orange and Columbia Counties. Reported in a few orchards in Columbia County on September 3. Also reported from Ulster County"; New Jersey, much more prevalent than for several previous years, "Severe on Baldwin, Maiden Blush, Grimes, Gravenstein, Stayman, Jonathan, Starking, Delicious, Winter Banana, and Rhode Island Greening. Reported from Middlesex, Monmouth, Gloucester, and Somerset Counties. General throughout the State"; Pennsylvania, local distribution, mostly in southeastern part of State, "Estimated total loss 0.2 percent, .08 percent in unsprayed orchards, .31 percent in partly sprayed orchards, and .11 percent in completely sprayed orchards"; less prevalent in Maryland than in 1937, but more prevalent than in an average year, scattered distribution, estimated total loss 2.5 percent; Virginia, much more prevalent than last year or in an average year, "owing to the frequent summer showers over most of the State. Late summer heat continued longer than usual. Bitter rot increased considerably over 1937 when it began building up. Late Bordeaux sprays have been widely discontinued in late years. Favorable conditions again in 1939 will bring a severe outbreak," total loss estimated at 1.5 percent; West Virginia, 0.1 percent loss; North Carolina, 1 percent; Georgia, 5 percent; Tennessee, 5 percent; Oklahoma, 1 percent; Arkansas, "For first time since 1930 the disease was not observed in two neglected orchards, the late frost having destroyed the fruit crop. Disease has not been commercially important for several years"; Ohio, 0.5 percent loss; Indiana, Illinois, Michigan, and Iowa reported traces.

Quince rust (Gymnosporangium clavipes): Massachusetts, less prevalent than for several previous years; New York, much less than in 1937, "No rain in Hudson Valley during bloom. None reported in Hudson

Valley this year (serious last year, especially Cortlands). Reported from Champlain Valley and specimens identified," estimated reduction in yield 0.1 percent; Pennsylvania, much less than for several previous years, "Not found in September survey of 398 orchards, but one apple specimen found in July"; Virginia and West Virginia, estimated reduction in yield was set at 0.2 percent; Arkansas, owing to small crop this disease was of no commercial importance; Indiana, Michigan, and Minnesota estimated a trace loss. Incidence and importance of quince rust on apple as affected by environmental and developmental factors, by Paul R. Miller (PDR 23: 80-82).

Hawthorn rust (Gymnosporangium globosum) was observed in Massachusetts as less prevalent than usual; New York, "No reports: Workers now in Hudson Valley are not distinguishing hawthorn rust leaf lesions from those of apple rust, G. juniperi-virginianae. All rust lesions sparse on apple foliage this year"; Oklahoma reported a loss of 1 percent; Michigan, Wisconsin, and Minnesota each reported a trace loss.

Apple rust (Gymnosporangium juniperi-virginianae): Maine estimated a trace loss; Massachusetts, 0.1 percent loss; New York, much less prevalent than in 1937, "Very light leaf infection, only scattering fruit lesions in southern Hudson Valley"; Pennsylvania, R. S. Kirby reported, "The smallest amount in the past 11 years. Not found on apples in unsprayed orchards, .03 percent on apples in partly sprayed orchards, .002 percent on apples in completely sprayed orchards," (PDR 23: 33); New Jersey, "General throughout the State"; usual prevalence in Maryland, estimated total loss 1 percent; the disease was observed in Virginia, causing 1.5 percent loss; West Virginia 0.2 percent loss; Oklahoma, much less than last year, a trace loss; Arkansas, according to J. C. Dunegan this disease was of no commercial importance owing to the small crop, though occasional specimens were collected"; Indiana, less prevalent than last year, estimated loss a trace; Michigan, trace loss; Wisconsin, local distribution, usual prevalence, total estimated loss, 1 percent; Minnesota, scattered distribution in southern part of State, the susceptible variety was Wealthy, estimated loss 1 percent; Iowa, usual prevalence, total loss 1 percent; Kansas, more prevalent than last year but less prevalent than in an average year.

Black pox (Helminthosporium papulosum) in Pennsylvania, according to R. S. Kirby and A. H. Bauer, has increased very rapidly during the past two years. In 1937 it was found in approximately 2 out of 400 orchards surveyed. This year it was recorded in 27 out of approximately 400 orchards surveyed. The disease varies greatly according to sections of the State. It was apparently most severe in areas having the heaviest summer rainfall (PDR 22: 429-430). The most susceptible varieties were Smokehouse and Grimes. Staymans were also susceptible. Estimated total loss 0.2 percent. The disease has also been increasing in storage. In orchards examined 2.5 percent of unsprayed apples were infected, .72 percent apples in partly sprayed orchards, .08 percent apples in completely sprayed orchards (PDR 23: 33). In Indiana, the disease was observed on Grimes, Rome, and Jonathan (PDR 22: 408-409).

Canker (Hypoxylon spp.), according to Carl G. Eide, was found fruiting on apple cankers in two places in Minnesota.

Fly speck (Leptothyrium pomi) was reported more prevalent in New York than in 1937; in Pennsylvania the disease was generally distributed, but "very severe in southeastern Pennsylvania," more prevalent than last year and much more prevalent than in an average year," 46.4 percent apples in unsprayed orchards were infected, 7.4 percent apples in partly sprayed orchards, and .83 percent in completely sprayed orchards," total estimated loss 2 percent; Maryland, general distribution, total loss 1 percent; Illinois; Wisconsin, usual prevalence.

Canker (Myxosporium corticolum) was reported from New Jersey on Astrachan, Winesap, Jonathan, Ben Davis, and Rome varieties.

Northwestern anthracnose (Neofabraea malicorticis) was found in Maine for the first time in 1938, and a hasty survey of some of the larger commercial orchards showed it to be widely distributed in the apple-growing region of the State on trees of the McIntosh variety (PDR 22: 354). In Washington it was reported in Lewis, Pierce, Kitsap, and Island Counties, with an estimated reduction in yield of 0.2 percent.

Fruit spot (Mycosphaerella pomi): Massachusetts, the unusual rainfall favored fruit infection by this disease in both apples and quinces. This year it is even more pronounced than usual in the Plymouth-Bristol Counties section of the State (PDR 22: 449); Connecticut, much more prevalent than in 1937 and more prevalent than in an average year; New York, estimated loss a trace; in Pennsylvania R. S. Kirby reported the heaviest infection since 1929, most severe in the southeastern part of the State, total loss was estimated at 0.5 percent (PDR 23: 33); New Jersey, "Very severe on Delicious, Greening, Jonathan, Stayman, and Rome varieties. Reported from Bergen, Cumberland, Gloucester, Hunterdon, and Somerset Counties"; Maryland, usual prevalence, total loss 0.5 percent.

Blister canker (Nummularia discreta): Pennsylvania, "Traces of this disease are found nearly every year"; Iowa, trace; Nebraska, general distribution, it was "favored by hot, dry weather"; Kansas.

Fruit rot (Penicillium spp.) was reported in Massachusetts as being more prevalent than for several previous years; New York; New Jersey, "Very severe in poorly kept storehouses"; P. expansum was the species named as active in Pennsylvania, causing a total loss of 0.5 percent.

Rot (Phoma mali): Pennsylvania.

Blotch (Phyllosticta solitaria) was reported from 19 States: Vermont estimated a trace loss; in New York, according to W. D. Mills, "No new cases--no change in two affected orchards in Wayne County";

New Jersey, "Severe on Winesap, Smith's Cider, Astrachan, and Twenty Ounce, in Burlington, Camden, Cumberland, and Middlesex Counties"; Pennsylvania, (PDR 23: 33), total estimated loss 0.2 percent"; Maryland estimated a loss of 0.5 percent; Virginia reported scattered distribution, with a trace loss, "Insoluble coppers unsatisfactory for control where observed"; West Virginia estimated 0.1 percent reduction in yield; North Carolina, 2 percent; Tennessee, 0.1 percent; Oklahoma estimated 4 percent loss, K. S. Chester reported blotch their most serious apple disease, according to State Nursery Inspector--"General, but most western stock free"; J. C. Dunegan reported from Arkansas, "No crop in most orchards--disease was of no importance this season from a commercial standpoint"; Ohio, estimated loss 0.2 percent; Indiana, 0.1 percent; Illinois reported, "Average prevalence, 21 percent; diseased fruit, 2.7 percent; leaf area destroyed, trace; diseased twigs, 0.01 percent. 100 percent of trees, 73.6 percent of fruit," estimated reduction in yield 1 percent, general only in south half of State, wet weather during the last half of May; Michigan, much more prevalent than for several previous years, estimated total loss a trace, "Found for first time in years in several orchards in Berrien County, on a few trees only in each case"; Wisconsin, "Considerable in orchards where no late application of fungicide was used"; Iowa, a trace; Nebraska, much more prevalent than in 1937, "Not so bad this year on early varieties, i.e., Dutchess, but worse on late varieties, i.e., Stark and Missouri Pippin"; Kansas, usual prevalence.

Black rot (Physalospora obtusa) was reported as causing losses in the following States:: Massachusetts, 1 percent; New York, 0.1 percent; New Jersey; Pennsylvania, 2 percent; Maryland, 0.5 percent reduction in yield plus 1 percent loss in grade; Virginia, trace; West Virginia, 0.1 percent; North Carolina, 0.5 percent; Tennessee, 0.1 percent; Oklahoma, 1 percent; Ohio, 0.1 percent; Indiana, trace; Illinois, 3 percent; Michigan and Wisconsin, traces; Nebraska and Kansas; in Pennsylvania, 4.3 percent apples infected in unsprayed orchards, 11 percent apples in partly sprayed orchards, .05 percent apples in completely sprayed orchards; "Continued clean-up of cicada wounds has reduced frog eye spot" in Virginia; H. W. Anderson reported from Illinois, "100 percent of trees, 1.2 percent of leaf area, 3.3 percent of fruit. Average for State: 100 percent of trees, 0.2 percent of leaf area, 0.76 percent of fruit. Extreme defoliation in many orchards in Calhoun County, the largest apple-growing county."

Fruit rot (Phytophthora cactorum): In Massachusetts, "decidedly more prevalent in storage than in most past seasons. The first reports concerned McIntosh apples that were harvested prior to the storm. Several additional reports concerned varieties such as Baldwin and Delicious harvested since the September storm" (PDR 22: 449-450): the disease in New York was more prevalent than for several years owing to "rainy weather after many apples were placed on ground under trees for coloring. This disease, relatively unimportant on apple fruit in the past may become much more important since the practice of spreading fruit on the ground for sun coloring is increasing rapidly"; in the University

orchard at Urbana, Illinois, this rot of apple fruit "was noticed on July 2. The infected fruit was mainly on the Grimes variety and mostly within a foot of the ground. The loss of fruit was not serious, since it was confined to the lower limbs. (PDR 22: 268-269).

Powdery mildew (Podosphaera leucotricha) was reported from New York, West Virginia, and Iowa, as causing 0.1 percent loss; Pennsylvania, Maryland, Virginia, North Carolina, Michigan, and Idaho, as causing traces of loss; Washington reported 0.2 percent.

Brown rot (Sclerotinia fructicola) was reported only from Pennsylvania.

Sporotrichum rot (Sporotrichum sp.) was found affecting from 1 to 3 percent of the apples of York and Winesap varieties in several shipments from Virginia (PDR 22: 190); also reported from Chelan County, Washington.

Silver leaf (Stereum purpureum) was observed in New York in Columbia and Niagara Counties.

Scab (Venturia inaequalis) was reported from 33 States as follows: Maine, estimated reduction in yield 2 percent; Vermont, much less prevalent than for several previous years, estimated reduction in yield 3 percent plus 5 percent loss in grade and storage; Massachusetts, more prevalent than last year, and much more prevalent than in an average year, estimated loss 12 percent; Rhode Island; Connecticut, estimated reduction in yield 5 percent; New York, less prevalent than in 1937, however, there was considerable infection even in some commercial orchards, estimated loss 2 percent; New Jersey, "Very severe in unsprayed orchards, common throughout the State"; Pennsylvania, "General in all orchards," estimated reduction in yield 10 percent plus 2 percent loss in grade and storage. The most susceptible varieties were McIntosh, Cortland, and Northern Spy"; Maryland, more prevalent than for several previous years, estimated reduction in yield was 2 percent plus 5 percent loss in grade and storage; in northern Virginia A. B. Groves reported 4 percent loss, less than in 1937 owing to early season being generally warm and dry; West Virginia reported scab more prevalent than last year or in an average year, "Moisture and temperature very favorable in central and western regions. Much less so in eastern commercial region," estimated total loss 4 percent; North Carolina and Georgia each reported 5 percent reduction in yield; from Kentucky W. D. Valleau reported, "Scab spores had evidently discharged to a great extent before bloom. The season appeared ideal for scab but an unusually small amount developed for a moist season"; Tennessee estimated 2 percent loss; in Oklahoma, according to K. S. Chester, "Leaf lesions were abundant but fruit showed very little scab"; John C. Dunegan reported from Arkansas, "Scab was more prevalent than for several years owing to the abundance of rain late in April and early in May, also the cool weather late in April and

through the month of May. Late freeze destroyed most of apple crop in northwest Arkansas--disease was important mainly as foliage disease and produced widespread premature defoliation"; the disease in Indiana was also more prevalent than for several years owing to "frequent rains during the early stages of growth," estimated reduction in yield 2 percent plus 6 percent loss in grade; Illinois, more prevalent than in 1937, "Wet weather first 2 weeks of April. Unfavorable from mid-April to May 10, very cold during middle of May and dry when warmer weather prevailed. 100 percent of trees; 27.5 percent of leaf area; 100 percent of fruit. State average: 84.6 percent of trees, 0.7 percent of leaf area, 21.6 percent of fruit. Infection very early (mature ascospores on February 20). Early season. About 25 days of dry weather, April 9 to May 4, kept early infection from becoming serious. Late infections common." Estimated reduction in yield 3 percent plus 3 percent loss in quality; general distribution in Michigan, "Rains during bloom and after. Dry weather during pre-bloom. Pink, 1st and 2nd cover sprays important. Non-caustic program successful in well sprayed orchards," estimated loss 10 percent; Wisconsin, much more prevalent than in 1937 owing to frequent rains, estimated reduction in yield was set at 10 percent plus 15 percent loss in grade, "Probably 90 percent of commercial sprayed orchards had a loss not to exceed 10 percent. Fully 75 percent of poorly sprayed and farm orchards lost 75 to 90 percent"; scab in Minnesota was also much more prevalent than during 1937, general distribution "everywhere apples are grown, wet, cool spring. One grower said it was the heaviest he had ever seen (in southeastern Minnesota where most of the apples are grown). Many orchards not properly sprayed were practically a total loss, loss for State 25 percent"; Iowa reported the disease more prevalent than for several years, estimated total loss 10 percent; Missouri reported the earliest date on record, according to M. A. Smith, of the finding of mature ascospores; North Dakota, trace; Iowa, much more prevalent than last year, "Severe infection on all trees where petal fall spray was late. Petal fall was early, April 20, and sprays at that time and at cluster bud gave good control"; Kansas; Montana; Idaho, and Colorado each reported a trace; Washington estimated 0.2 percent loss.

Blight (Bacillus amylovorus) was reported from 27 States. Vermont, Massachusetts, and New York each reported an estimated loss of a trace; New Jersey, "Observed on Grimes, Stayman, McIntosh, and Twenty Ounce. Heavy vegetative growth brought about by the abnormally high temperatures during the latter part of April and the first part of May increased the infection. General and severe throughout the State"; Pennsylvania, more prevalent than last year and much more prevalent than in an average year, total loss 2.5 percent. The most susceptible varieties were Rhode Island Greening, and Yellow Transparent; Maryland, usual prevalence, loss 1.5 percent; more prevalent in northern Virginia than last year, estimated total loss 0.3 percent; also more prevalent in West Virginia, total loss 0.5 percent, the most susceptible varieties were Grimes and Jonathan; North Carolina, "Blight was very severe in 1938, especially in the

mountains." Estimated reduction in yield 8 percent (PDR 22: 289); Georgia, 2 percent loss; Tennessee and Oklahoma, 1 percent loss; Texas; Ohio, 2 percent loss; more prevalent than for several years in Indiana, estimated loss 2 percent, the most susceptible varieties were Wealthy, Jonathan, and Transparent; Illinois, less prevalent than last year and much less prevalent than in an average year owing to the dry weather during bloom period in most sections, "100 percent of trees, 3.5 percent of twigs. Average for the State: 2 percent of trees, 0.04 percent of twigs. More prevalent in northern sections than in southern"; Michigan and Wisconsin each reported 1 percent loss; Minnesota, 2 percent loss, "Rain in May and June"; Iowa, more prevalent than last year and much more prevalent than in an average year, 5 percent reduction in yield; North Dakota, general distribution, more prevalent than usual, total loss 2 percent; in Nebraska blight was more prevalent than last year and less prevalent than in an average year, weather was moist during May and early June, susceptible varieties were Jonathan, Yellow Transparent, Wealthy, and York; Kansas; Montana, 3 percent loss; Wyoming, 5 percent loss; Idaho and Washington, traces.

Crown gall (Bacterium tumefaciens) was reported from the following States: New York, New Jersey, Maryland, Wisconsin, and Kansas. In Wisconsin the disease was "Mostly a nursery disease"; Minnesota, "No report this year. Probably quite a bit in nurseries"; Kansas, "In nursery stock."

Blister spot (Pseudomonas papulans) was reported by G. L. Zundel from Pennsylvania for the first time on Stayman apples in Franklin County. It had been noted in previous years but was confused with suppressed scab. In Missouri, according to M. A. Smith, this disease was observed on fruit of the variety Rome Beauty.

Mosaic (virus) was observed in New York in Orange, Wayne, Monroe, and Orleans Counties.

Green mottle (unknown, virus suspected) was reported from New York by W. D. Mills. "A peculiar green mottling of Dutchess apple fruits in an orchard in Greene County. Its presence was noted for several years and it is believed to be spreading slowly. Trees look normal. This green mottle is believed to be the same trouble found several years ago on Dutchess fruits upon one tree in Ulster County."

Bitter pit (Baldwin spot, stippen: non-parasitic) was reported from Massachusetts as causing a loss of 2 percent; New York, local distribution; New Jersey, reported on Gravenstein, Grimes, Stayman, Winesap, Smokehouse, Winter Banana, and Baldwin; in Maryland the most susceptible varieties were Jonathan and King David, estimated total loss 1 percent; Wisconsin reported the disease less prevalent than last year, "At Sturgeon Bay, on Wealthy and Dudley varieties 1 to 2 percent of fruits were affected."

Cork (non-parasitic) in Massachusetts and New York was less prevalent than in 1937 and much less than in an average year. In New York A. B. Burrell reported as follows: "Weather was unfavorable for cork, but another factor was that boron applications were made in a large percentage of the acreage where it has been serious in previous years. Heavy mulching over several years, which gives partial control, has been practiced in some orchards subject to cork"; usual prevalence in Maryland, total loss 0.5 percent; in northern Virginia this disease is important on "Ben Davis and Gano varieties only. The widespread use of borax seems to have nearly eliminated this once troublesome disease of these varieties." It was less prevalent than in 1937 and much less so than in an average year."

Drought spot (non-parasitic, attributed to boron deficiency) was much less prevalent in New York than for several previous years.

Internal breakdown (non-parasitic) was reported from New York; usual prevalence reported in Maryland, 0.5 percent was the estimated total loss.

Leaf scorch (non-parasitic) was reported by Donald Folsom and M. T. Hilborn in southwestern Maine, New Hampshire, and Massachusetts, where it was probably due to ocean spray (PDR 22: 463); a leaf scorch was also reported from many sections of New York, apparently more common in young plantings, some of which had not received spray applications (PDR 22: 335).

Measles (unknown) reported from Dutchess, Ulster, and Orange Counties, New York.

Rosette (non-parasitic, due to boron deficiency) was observed in New York as being less prevalent than last year or in an average year, and causing a trace loss.

Scald (non-parasitic): New York and Virginia.

Water core (non-parasitic): New York and New Jersey.

Spray injury (various spray materials): From Massachusetts O. C. Boyd reported the usual amount of injury on apple foliage from early-season application of lime-sulfur plus lead arsenate. More than the usual amount of fruit russet on Delicious was reported generally; severe sulfur dioxide injury was reported from Connecticut; in New York arsenical injury was more prevalent than usual, copper injury was less prevalent, cyanamid caused "one severe case in Orleans from 1937 and one medium case from 1938 application in Schenectady County," oil injury was less prevalent, the use of lime sulfur caused russeting. "Severe russeting and cracking of apples noted in Niagara County where trees were interplanted with peaches receiving zinc-lime. The drift caused the injury"; in New Jersey fruit russeting was reported more general than

usual, because of cool, wet weather following the spray application, "Rather severe injury was observed where 1-3-50 Bordeaux mixture was used as the fungicide for the second cover spray"; spray injury was less prevalent in Maryland than for several years; Michigan reported arsenical spray injury causing a reduction in yield of 5 percent.

Weather injuries: Losses from frost injury were reported as follows: Vermont, 15 percent; Connecticut, 1 percent; New York, 2 percent, freezing injury was also reported (PDR 22: 112-113); in New Jersey "injury varied from one bud to all buds in a cluster. More serious at low elevations. McIntosh and Gravenstein were the most severely affected"; Virginia, 6 percent; West Virginia, 45 percent, "Crop practically destroyed in many localities in central and western regions. Generally slightly injured in eastern region"; Georgia, 5 percent; Ohio, 40 percent; Indiana, 10 percent; Michigan, 20 percent; Wisconsin, 10 percent, "Heavy frosts May 12 and May 24. West side of trees very much thinned. Bad in low orchards. Orchard heating in 15 or more cases with good results"; Nebraska, "Most in extreme southeast. Severe loss to Dutchess and Jonathan in Richardson County, other sections practically free"; Iowa, Montana, and Idaho each a trace; Washington, 1 percent. Storm injury: Maine and Connecticut each reported an estimated loss of 50 percent; Massachusetts, 45 percent (PDR 22: 390). Sunscald in Michigan was observed as causing 2 percent reduction in yield. "Most of the damage reported probably due to damage done in 1936, which continues to result in dead trees." Winter injury: New York; New Jersey, "Observed in every county, Gravenstein, Grimes, and McIntosh severely affected"; Georgia, 2 percent; Tennessee, 60 percent; West Virginia, Ohio, Iowa, and Montana, traces; North Dakota, 2 percent; Idaho, no loss; Washington, 2 percent.

MANGIFERA INDICA. MANGO:

Blossom blight (Colletotrichum gloeosporioides) in Florida was not severe even in unsprayed trees of the Haden variety, owing to the dry spring. Later a heavy drop began. Since the weather was quite dry during the entire blossoming period and the condition was as serious in sprayed as in unsprayed trees, it was concluded that the abnormally heavy drop was due to low temperature injury (PDR 23: 38-39); Puerto Rico.

MANGO. See MANGIFERA INDICA.

MORUS spp. MULBERRY:

Leaf spot (Cercosporella mori): In Oklahoma, "This is only one of several leaf spots which became quite prevalent in 1938 on mulberry."

Popcorn disease (Sclerotinia carunculoides): For known distribution of this disease on M. alba, see P.D.R. 22: 435-438.

Mulberry blight (Bacterium mori) was present on Russian mulberry (M. alba tatarica) in some nurseries in Iowa, causing a trace loss, according to I. E. Melhus.

Root knot (Heterodera marioni) in Oklahoma was "Present in nursery stock at one location. Hard to find and not very destructive."

Frost injury was reported from Illinois as causing complete necrosis of foliage and partial to complete necrosis of present season's shoot growth (PDR 22: 434-435).

MULBERRY. See MORUS spp.
NECTARINE. See AMYGDALUS PERSICA NECTARINA.
PEACH. See AMYGDALUS PERSICA.
PEAR. See PYRUS COMMUNIS.

PERSEA AMERICANA. AVOCADO:

Blotch (Cercospora sp.) was more prevalent than for several years in Florida (PDR 23: 38); Texas in Hidalgo County.

Fruit rot (Colletotrichum sp.) was reported from Florida as being "Usually if not always secondary to blotch, causing a ripe rot of fruit"; Texas in Hidalgo County; Puerto Rico.

Anthracnose (C. gloeosporioides) in Florida was somewhat more serious than usual during 1938 and control by spraying with copper sprays was less effective than during 1937 (PDR 23: 38).

Powdery mildew (Oidium sp.) was of minor importance in Florida this past season (PDR 23: 38).

Scab (Sphaceloma perseae) was less prevalent than for several years in Florida owing to drouth in spring months which was not favorable to infection. "Of commercial importance only on Lula variety, since black spot spraying keeps it in check on other varieties. Fuerte not planted commercially" (PDR 23: 38).

Tipburn (non-parasitic) was very general in Florida (PDR 23: 38).

PLUM. See PRUNUS spp.
POMEGRANATE. See PUNICA GRANATUM.
PRUNE. See PRUNUS DOMESTICA.

PRUNUS ARMENIACA. APRICOT:

Blight (Coryneum beijerinckii): Idaho and Washington.

Brown rot (Sclerotinia fructicola) in apricots shipped from California was the most destructive it has been for several years (PDR 22: 404). S. laxa was reported from Washington.

Powdery mildew (Sphaerotheca pannosa) appeared in New York, "Specimens received from Putnam County, also observed in one Niagara County orchard. Apricots are not widely grown in New York."

Fireblight (Bacillus amylovorus) was reported from Texas in Travis County.

Canker (Bacterium cerasi) was observed locally in Pennsylvania. This is the first report to the Survey on this host from the State.

Bacterial spot (B. pruni): Oklahoma and Illinois.

Leaf spot and necrosis (drought injury): Washington.

PRUNUS DOMESTICA. PRUNE:

Root rot (Armillaria mellea): Washington, in Clarke County.

Black knot (Plowrightia morbosa): New York, A. J. Nichols reported from Orleans County that "New black knot infections from last year are hard to find in most prune plantings."

Brown rot (Sclerotinia spp.): Washington, "General, west side"; S. fructicola was reported from New York in Dutchess and Niagara Counties, "unsprayed prunes exhibited serious brown rot."

Mosaic (virus): New York in Niagara County, total loss a trace.

Frost and wind injuries were much more prevalent in New York than for several years. In Niagara County J. G. Goodrich reported, "Russetting is serious on prunes due to the winds and frost but crop is heavy" (June 20).

Spray injury: Arsenical injury was more prevalent than usual, in Orleans County, "Serious arsenical injury was noted on prunes where two lead applications were made for curculio."

PRUNUS spp. CHERRY:

Scab (Cladosporium carpophilum) was less prevalent in New York than last year or in an average year, according to G. C. Kent. No loss was reported.

Leaf blight (Coccomyces hiemalis) was prevalent, and in many sections severe. Losses ran high in some States. Michigan estimated 20 percent, "Most severe in Oceana and southern counties; Virginia and Wisconsin (sour cherry) each 10; Pennsylvania and Ohio each 8; Maryland (sour cherry) and West Virginia each 5, in West Virginia "Generally light set due to frost injury caused some neglect in following spray programs"; North Carolina, Oklahoma, and Indiana each 3 percent; Illinois, 2, "In sharp contrast to last year, when disease was extremely bad, appeared this year so late as to cause little injury to the crop." Other States, including Massachusetts, New York, New Jersey, Arkansas, Iowa, Nebraska, Kansas, Montana, and Washington reported from a trace to 1 percent or gave no estimates.

Blight (Coryneum beijerinckii) was much less prevalent in Idaho than last year, trace loss; Washington in Yakima County.

Black knot (Plowrightia morbosa) was reported from New York and New Jersey.

Powdery mildew (Podosphaera oxyacanthae): Iowa, less prevalent than for several years; Idaho, usual prevalence, total loss estimated at 10 percent. "Dry lime-sulfur spray gave good control in one orchard."

Brown rot (Sclerotinia fructicola) was observed in Massachusetts as being more prevalent than in 1937, estimated total loss 8 percent (PDR 22: 297); New York, observed on sweet cherries in Ulster, Niagara, and Nassau Counties, observed on sour cherries in Oswego County, causing moderate injury, also observed in Hudson Valley, estimated loss for State 1 percent; Maryland, more prevalent than in an average year, 3 percent reduction in yield plus 1 percent loss in grade; prevalent in many orchards throughout New Jersey; 5 percent loss was estimated in Pennsylvania; Virginia, more prevalent than for several years owing to very wet spring, 10 percent loss; West Virginia, 0.5 percent loss; North Carolina, 5 percent; Tennessee and Arkansas, each a trace; Oklahoma, 2 percent; Indiana, scattered distribution, more prevalent than usual, total loss 3 percent; Michigan and Wisconsin, traces, in Wisconsin, "Slight blossom blight, green fruit and ripe fruit infection"; in Iowa I. E. Melhus reported the disease more prevalent than in 1937, estimated reduction in yield 5 percent; Kansas; Washington, in Kitsap and King Counties, estimated loss 0.5 percent; except for from 3 to 5 percent brown rot in a few small early-season express shipments from California, there was little decay in cherries arriving at New York City from the West (PDR 22: 404).

Silver leaf (Stereum purpureum): W. D. Mills reported recovery from this disease of Montmorency cherries in New York. High temperatures appeared to explain this (PDR 22: 430-431). "Montmorency block heavily infected in 1935 showed no silver leaf in 1937 or 1938."

Leaf curl (Taphrina cerasi): Washington.

Bacterial gummosis (Bacterium cerasi): Cankers were found this spring for the first time in Dutchess and Ulster Counties, New York, causing serious damage to young plantings of sweet cherries, the two varieties showing most injury being Giant and Black Tartarian (PDR 22: 272); in Pennsylvania, "The disease seems largely confined to Erie County, where about 20 percent of sweet cherry trees are infected and an average loss of 3 percent occurs," this is the first report in the Survey files from Pennsylvania; Washington, in Pierce County.

Bacterial spot (Bacterium pruni): New York, trace; New Jersey; Oklahoma, "Severe, our leading stone-fruit disease."

Mottle leaf (virus) was reported widespread in Idaho. Total loss 1 percent.

Pink cherry (virus) occurred in Washington in King, Pierce, and Thurston Counties.

Leaf drop (non-parasitic) was reported more prevalent in New York than in 1937 and much more prevalent than in an average year. According to W. D. Mills, "This is probably another manifestation of winter injury. There was a considerable amount in 1928, 1930, 1931. Some marked trees in a Wayne County orchard have shown the trouble each severe year since 1930."

Weather injuries: Frost injury was reported much more prevalent in New York than in 1937 on both sour and sweet cherries, estimated total loss 20 percent; in New Jersey "Frost preceded blooming period, and reduced crop about 60 percent"; West Virginia reported 55 percent reduction in yield; V. H. Young reported, "Cherry crop mostly in northwest Arkansas was nearly a failure due to frosts at blooming," estimated reduction in yield 90 percent; Ohio estimated 60 percent loss; Indiana, 25 percent; Michigan, 30 percent; Wisconsin, much less than for several years, estimated loss 10 percent, "Frosts of April 7-8 and April 20-21 did some damage on exposed locations in Door County"; Montana and Idaho each reported a trace. Winter injury: New York reported, "Winter injury killed many trees in Hudson Valley and lesser numbers in western New York as a result of premature defoliation in 1937 by leaf spot followed by low winter temperatures"; Wisconsin reported winter injury less prevalent than for several years, 5 percent was the estimated loss.

PRUNUS spp. PLUM (See also P. domestica, prune):

Green mold rot (Alternaria sp. and Cladosporium sp.) was more common than usual on prune plums shipped from Oregon and Idaho (PDR 22: 408). Scab (C. carpophilum) was more prevalent in Wisconsin than last year, "General in northern Wisconsin."

Shot hole (Coccomyces prunophorae) appeared in New Hampshire; less prevalent in New York than for several previous years; in Pennsylvania, "5 acres were badly defoliated; Minnesota, "two reports," Martin and Ramsey Counties; Kansas, "Some noted--not many plums have survived drought years."

Blue mold rot (Penicillium sp.) was observed on Italian prune plums shipped from Oregon and Idaho to New York late in season, causing 2 to 3 percent infection (PDR 22: 408).

Black knot (Plowrightia morbosa): New Hampshire, more prevalent than last year or in an average year, total loss 7 percent; Connecticut, usual prevalence; New York reported, "Much more black knot than in the average year in commercial prune orchards (infection of May 1937)"; New Jersey, "Generally distributed but not serious"; in Maryland there was an estimated reduction in yield of 4 percent, more prevalent than in an average year; Wisconsin reported, "Very few plums grown, Lombard variety was susceptible"; Iowa, usual prevalence, trace loss; Texas.

Powdery mildew (Podosphaera leucotricha) in Nebraska was more prevalent than last year owing to "moist, cool nights in August."

Brown rot (Sclerotinia fructicola) was reported from 12 States. Of these only Wisconsin, Iowa, and Nebraska reported more than the usual prevalence. In Massachusetts it was notably conspicuous and damaging (PDR 22: 297); New York reported a total loss of 5 percent; Maryland, 5 percent reduction in yield plus 2 percent loss in grade; observed in 4 counties in Illinois, "undoubtedly equally prevalent elsewhere. On trees examined 54 percent of fruit infected." Elsewhere it was of no material importance or less common than usual.

Rust (Tranzschelia pruni-spinosae): Oklahoma, "Infection frequent and often severe in the eastern part of the State"; Texas, in Harris County, also reported on wild plum in Cherokee County.

Plum pockets (Taphrina pruni) in Massachusetts is limited primarily to the eastern and southeastern shoreline sections of the State. Unusual losses on the Cape, especially in beach plums. Not only is leaf infection more severe, with marked defoliation, but in many bushes the heavy set of fruit is a complete loss due to fruit infection (PDR 22: 256-257); New York, in Franklin County; Oklahoma, "General in the moist northeastern part of the State, and often destructive"; Wisconsin, "Quite severe in northern part of State"; more prevalent in Minnesota than for several previous years owing to much rain and cool weather in the early season; North Dakota, more prevalent than in 1937, total loss 1.5 percent.

Bacterial spot (Bacterium pruni) appeared in traces in New Hampshire, New York, New Jersey, Maryland, Texas, and Wisconsin.

Crown gall (B. tumefaciens): Maryland and Texas.

PSIDIUM GUAJAVA. GUAVA:

Red alga (Cephaleuros mycoidea): Florida (PDR 23: 39-40).

PUNICA GRANATUM. POMEGRANATE:

Black mold rot (Aspergillus niger): California (PDR 23: 68).

Blotch (Mycosphaerella lythracearum): Florida (PDR 23: 40).

Blue mold rot (Penicillium sp.): California (PDR 23: 68).

Sulphur dioxide injury on fruit shipped from California (PDR 22: 406).

PYRUS COMMUNIS. PEAR:

Fruit rot (Botrytis cinerea) is becoming less important each year (PDR 22: 192).

Cladosporium rot (Cladosporium sp.): California (PDR 22: 192; 23: 67).

Leaf blight (Fabraea maculata) was reported from 11 States: in Louisiana, according to A. G. Plakidas, it has been on the increase during the past 5 to 6 years for some unknown reason; North Carolina reported the highest percentage loss, which was 15, "This disease caused severe loss, resulting in 100 percent fruit infection and total defoliation on many trees early in the summer, much more severe than in other recent years"; H. W. Anderson reported from Illinois, "Caused severe defoliation on Kieffer in some parts of the State," estimated reduction in yield 5 percent; Maryland reported a loss of 3 percent; other States reporting from trace to 1 percent loss were Massachusetts, New York, Pennsylvania, Michigan, Wisconsin, Virginia, and Oklahoma.

Sooty blotch (Gloeodes pomigena): New York; Texas; Oklahoma.

Bulls-eye rot (Gloeosporium perennans and Neofabraea malicorticis): Oregon (PDR 22: 192).

Sooty blotch (Leptothyrium pomi) was more prevalent than for several years in New York.

Leaf spot (Mycosphaerella sentina) was reported from New York as being less prevalent than last year or in an average year.

Scab (Venturia pyrina): 14 States reported the presence of scab, but it was relatively unimportant except in Massachusetts, where it was "Severe on the highly susceptible varieties; Wisconsin reported 10 percent estimated loss and Maryland 2.5 percent.

Blight (Bacillus amylovorus) was reported as follows: Massachusetts, New York, Texas, Illinois, and Minnesota each reported a trace loss; New Jersey, "Very severe in many orchards throughout the State"; Pennsylvania, 15 percent loss; Maryland, usual prevalence, 10 percent loss; Virginia, "Few pears remain under high culture and blight is seldom troublesome on old Kieffers"; in North Carolina, "Blight was severe, especially in the mountains"; Georgia reported an estimated loss of 50 percent; Louisiana, usual prevalence; Oklahoma, 3 percent loss; Ohio, 6 percent; Indiana, 20 percent, more prevalent than for several previous years; Michigan, 5 percent; Wisconsin, local distribution, "Only a few trees in southeastern Wisconsin"; Iowa, more prevalent than for several years, 3 percent reduction in yield; Nebraska, "More prevalent than last year owing to May rains. The Bartlett was the most susceptible variety"; Kansas, much less than in an average year; Idaho, much more prevalent than for several previous years, "Many young orchards ruined"; Colorado, 10 percent reduction in yield; Washington, in Benton County.

Crown gall (Bacterium tumefaciens) was reported from Greene County, New York. "Specimen sent in found in lot of young pear trees just purchased from nursery."

Stoniness (virus): Washington.

Brown blotch (unknown): R. F. Poole wrote, "This disease caused severe damage and caused many pears to drop prematurely." This is first report of this disease to the Survey from North Carolina.

Frost injury was observed in Connecticut, causing 10 percent estimated loss; in New York, trace; in Ohio, 30 percent; and in Indiana, 10 percent.

Spray injury (various spray materials) was very severe on some varieties in New York.

QUINCE. See CYDONIA OBLONGA.
RASPBERRY. See RUBUS spp.

RIBES GROSSULARIA. GOOSEBERRY:

Leaf spot (Mycosphaerella grossulariae) was more prevalent in Wisconsin than in 1937.

Anthracnose (Pseudopeziza ribis) appeared in New Jersey, "In one or two plantings every plant in the field was affected"; Wisconsin, more prevalent than last year.

Rust (Puccinia grossulariae) was reported from New York in Ulster County; New Jersey, Burlington and Warren Counties; Minnesota, in Becker and Meeker Counties.

Leaf spot (Septoria ribis): Moderate to severe infection in New York.

Powdery mildew (Sphaerotheca mors-uvae) caused considerable damage in Ulster County, New York, where no control measures were used (C. G. Small); more prevalent in Wisconsin owing to the wet weather; Idaho, usual prevalence, total estimated loss 5 percent, "Good control in plots at Genesee with lime-sulfur."

Mosaic (reported as due to virus) from Madison County, Illinois.

RUBUS spp. CANE FRUITS:

BLACKBERRY: Besides various diseases reported about as usual, the following were reported:

Bud blight (Botrytis sp.): "Severe fruit infection in one planting in Middlesex County, New Jersey; Washington, in Pierce, Lewis, and Grays Harbor Counties.

Anthracnose (Elsinoe veneta) was reported more prevalent than usual in New York; in New Jersey, "General distribution in south Jersey, but no heavy losses"; Kansas; Washington, in Pierce County.

Sooty blotch (Gloeodes pomigena) was observed in Cherokee County, Texas. This is first report of this disease on wild blackberry from Texas.

Orange rust (Gymnoconia peckiana) was reported more prevalent than in 1937 in New York; New Jersey reported the rust severe on most varieties in Burlington, Middlesex, and Union Counties, but not the cause of great losses; Pennsylvania estimated 2 percent loss; Texas, in Smith County; in Illinois, H. W. Anderson reported the disease "unusually prevalent throughout the State. On wild blackberries it is so prevalent that large areas show nearly 100 percent infection" (PDR 22: 186); more prevalent than for several previous years in Wisconsin; Washington, in Okanogan County.

Cane rust (Kuehneola uredinis) was reported more prevalent than for several previous years in New York. "Found in two patches about 4 miles apart near New Paltz, Ulster County. A few plants affected in Chautauqua County."

BOYSENBERRY: Anthracnose (Elsinoe veneta) and powdery mildew (Sphaerotheca humuli) were reported from Washington.

Wilt (Verticillium albo-atrum) was reported by R. F. Suit as being very severe in one planting in Monroe County, New York.

DEWBERRY: Reports on diseases of dewberry indicate little change from previous years except in Wisconsin. Anthracnose (Elsinoe veneta) was much more prevalent than in 1937 and more prevalent than in an average year owing to the wet weather.

RASPBERRY: Spur blight (Didymella applanata; see also M. rubina) was observed in New York in Chautauqua and Ulster Counties; Minnesota reported it more prevalent than for several previous years.

Anthracnose (Elsinoe veneta) in Massachusetts caused a total loss of 5 percent, more prevalent than last year and much more prevalent than in an average year; slight to severe infection in New York, more prevalent than for several previous years; in New Jersey, "Severe in one planting in Monmouth County, present in Bergen and Middlesex Counties"; less prevalent in Pennsylvania, estimated reduction in yield 3.5 percent; the disease in Maryland was more prevalent than for several years, owing to "Susceptible varieties grown, weather favorable to the disease, and failure to spray and practice rigid sanitation," estimated reduction in yield 5 percent; in Illinois the disease was reported from Union County; in Wisconsin it was more prevalent than last year on red raspberry and much more prevalent on black raspberry owing to the wet weather; total loss in Iowa was estimated at 5 percent, less prevalent than last year; Carl J. Eide from Minnesota reported, "More prevalent on reds than it has been for many years in this State. Caused almost total failure of some black," total loss 10 percent; general distribution in east end of Nebraska, "Much more prevalent than in 1937 owing to early and August rains. Cumberland was the most susceptible variety"; usual prevalence on black raspberry in Kansas, "No fruit infection noted but cane lesions severe in unsprayed fields"; Washington, in Pierce, Thurston, and Clarke Counties.

Double blossom (Fusisporium rubi) was generally of the usual prevalence in Maryland.

Orange rust (Gymnoconia peckiana) on black raspberry in New York caused slight infection; Pennsylvania; much less prevalent in Maryland than for several previous years, caused only a trace loss; in Wisconsin it was more prevalent than last year.

Cane blight (Leptosphaeria coniothyrium) appeared on black cap raspberries in New Hampshire; Massachusetts reported the same amount as last year, total loss a trace; observed on black raspberry in Chautauqua County, New York; in Pennsylvania Zundel reported a total

loss of 13 percent; in Maryland it was "Most severe on Latham (not serious on Cumberland) in association with spur blight," 1 percent was the estimated loss; North Dakota, "Not observed this year"; Kansas and Washington.

Leaf spot (Mycosphaerella rubi) was of little importance in the States reporting.

Spur blight (cause reported as M. rubina) caused a total loss of 4 percent in Massachusetts; more prevalent than for several previous years in New York, "Particularly severe in the Hudson Valley"; "Very severe in North Jersey on late variety"; usual prevalence in Pennsylvania and Iowa.

Western yellow rust (Phragmidium rubi-idaei) was reported from western Washington.

Leaf rust (Pucciniastrum americanum) in New York caused slight to severe injury, more in Hudson Valley.

Powdery mildew (Sphaerotheca humuli) was reported more prevalent than usual in New York; Minnesota reported, "More mildew than for many years. Lots of rain in the early part of the season"; Washington, in Pierce and Lewis Counties.

Verticillium wilt (Verticillium albo-atrum) was more prevalent in New York on black, purple, and red raspberries than for several previous years; Pennsylvania, first report to the Survey from State on this host.

Blight (resembling blight caused by Bacillus amylovorus): Pennsylvania (PDR 22: 271).

Crown gall (Bacterium tumefaciens) continues to be important in many States and constitutes a major problem in Pennsylvania, where it was more prevalent than for several previous years, causing 8 percent reduction in yield; from North Carolina, R. F. Poole wrote, "Large demonstrational plantings in the piedmont and mountain areas have been destroyed by this disease."

Leaf curl (virus) was reported in Pennsylvania with the usual prevalence; much less prevalent in Maryland and less prevalent in Wisconsin than for several years.

Mosaic (virus) continues to be a factor of importance. It was reported as follows: Massachusetts, usual prevalence, 20 percent loss; New York, "General, slight to severe injury, very severe in the Hudson Valley"; Pennsylvania, 6 percent loss; Maryland, 2 percent loss; District of Columbia; Minnesota, more prevalent than heretofore, 14

percent was the estimated reduction in yield, "Mosaic is increasing in fruiting patches owing to use of stock from old fields for planting"; Wisconsin, "Found a trace on 4 out of 5 properties, much less than 10 years ago"; Iowa, total loss 7 percent; Kansas; and Washington.

Streak (virus) in Pennsylvania was reported as less prevalent, loss was estimated at 6 percent; on black raspberries only in Maryland, 3 percent reduction in yield.

Winter injury: Much more prevalent in New York than for several years; "Warm weather in late winter started growth, then cold weather following caused injury without regard to usual hardiness of the variety," total loss was 5 percent; also more prevalent in Minnesota, "Injury ranging from complete killing of canes to dropping of nearly ripe fruit was very common. Roots not injured and new growth was very vigorous"; Washington.

STRAWBERRY. See FRAGARIA sp.
TI-ES. See LUCUMA NERVOSA.

VACCINIUM MACROCARPON. CRANBERRY:

The keeping quality of cranberries in Massachusetts and Wisconsin in 1938, by H. F. Bergman and Neil E. Stevens, respectively, was given in the Reporter (PDR 22: 397, 461).

Storage rots (Penicillium, etc.) were more prevalent than in 1937 in Wisconsin owing to the wet weather.

False blossom (virus) was reported as usual from Wisconsin but less than in an average year. R. E. Vaughan reported, "Considerable spraying and dusting effective in leaf-hopper control prevents spread of virus."

VITIS sp. GRAPE:

Dead arm (Cryptosporella viticola) occurred in New York and Iowa, causing a trace loss.

Anthracnose (Elsinoe ampelina) in New Jersey was "Severe on Concord variety in one vineyard, also reported from Passaic County"; Maryland and Florida reported the usual prevalence, with a trace loss; Wisconsin, in "Dodge County on Brighton, not general."

Black rot (Guignardia bidwellii): Of the 20 States reporting, the majority reported the usual prevalence or more, only Florida reported less, and Arkansas and Texas reported much less prevalent. Losses estimated were 5 percent in Massachusetts, 15 percent in Connecticut; 2 percent in New York; in New Jersey no estimate was given, "Cause of

great loss"; 10 percent in Pennsylvania; 15 percent in Maryland, "Severe only in unsprayed vineyards"; 20 percent in Virginia, "Very wet spring"; 25 percent in Tennessee; 17 percent in North Carolina, "Caused much damage since very few grapes are sprayed in home gardens"; 5 percent in Florida; in Texas and Arkansas a trace; in Oklahoma 7 percent; in Ohio 3.5 percent; in Indiana 10 percent, "Frequent rains during May and June"; in Illinois no estimate was given, reported from Jefferson County; in Michigan a trace; in Wisconsin 5 percent; in Iowa 0.1 percent; Kansas, no estimate was given, same prevalence as last year.

Bitter rot (Melanconium fuligineum) caused about the usual injury in Florida, where reduction in yield was estimated at 5 percent, with the same amount of loss in quality; Illinois.

Downy mildew (Plasmopora viticola) caused losses generally of little importance, being confined to a trace in most of the 13 States reporting its presence. Losses in Massachusetts were set at 1.5 percent; Maryland, 3 percent; and Virginia, 4 percent.

Powdery mildew (Uncinula necator) was observed in Massachusetts, New York, Pennsylvania, Maryland, Tennessee, North Carolina, Indiana, Michigan, Wisconsin, Iowa, Idaho, and Washington. North Carolina estimated the highest reduction in yield, which was 2 percent; the next highest was 1 percent for New York; and the remainder of the States reported traces.

Crown gall (Bacterium tumefaciens) was of little importance this year, only observed in Maryland and Texas.

Weather injury: Frost injury was serious in some States. On May 23, W. J. Clark reported as follows from Rockland County, New York: "The hard frosts a week ago killed about 80 percent of the grapes in the county." The State estimated the total loss at 2 percent; in New Jersey, "Buds and leaves killed in local areas in Bergen County"; Arkansas, much more prevalent than for several previous years, V. H. Young wrote, "Frosts of April 2, 9, and 10 destroyed young shoots and flower clusters, mostly in Northwestern Arkansas," the estimated loss was 40 percent; Ohio reported an estimated reduction in yield of 60 percent; Indiana, 20 percent; Illinois, on V. labrusca (PDR 22: 434-435); Michigan reported 95 percent loss. "Grapes frozen out generally except in a few favored locations"; a trace loss was observed in Idaho. Storm injury (hurricane of September 21) caused an estimated total loss of 50 percent in Massachusetts. Winter injury caused a loss of 50 percent in Tennessee and a trace in Iowa.

ZIZYPHUS JUJUBA. CHINESE JUJUBE:

Rust (Phakospora zizyphi-vulgaris) was destructive and abundant at the Sub-Tropical Experiment Station, Florida (PDR 23: 40).

DISEASES OF NUT CROPS

For peanut see Arachis hypogea under Special Crops and for chestnut see Castanea under Trees.

CORYLUS sp. FILBERT, HAZELNUT:

A summary of filbert diseases in the Pacific Northwest in 1938, by Paul W. Miller, was given in the Reporter (PDR 22: 399-400). Gnomoniella corylii, leaf spot, was reported from Jackson County, Oregon, for the first time (PDR 22: 68). Other diseases reported were fruit drop and leaf necrosis from Washington.

HICORIA PECAN. PECAN:

Cercospora fusca, brown leaf spot, was reported from Texas in Bell and Nueces Counties. Cladosporium effusum, scab, occurred in San Augustine County, Texas. Microsphaera alni, powdery mildew, was reported again this year in Bell County, Texas. Pestalozzia uvicola, leaf spot: Texas, in Jefferson County. Bacterium tumefaciens, crown gall, in Oklahoma, according to Chester, was found frequently in nursery stock. This is the first report of crown gall on this host to the Survey from Oklahoma. Black heart (cause unknown): R. F. Poole from North Carolina reported, "Black rot of the inner nut before maturity is causing heavy loss. There is no evidence of insect injury and parasites being associated with the trouble."

JUGLANS REGIA. PERSIAN WALNUT:

Diseases of Persian walnut in the Pacific Northwest were also reported by Paul W. Miller (PDR 22: 398-399). For reports on butternut, J. cinerea, and black walnut, J. nigra, see Juglans under Tree Diseases.

Gnomonia leptostyla, anthracnose, was reported from Nebraska by R. W. Goss. New Jersey also reported the disease.

Marssonia juglandis, leaf spot, occurred in Whatcom County, Washington.

Bacterium juglandis, bacterial blight, was observed in Whatcom and Skagit Counties, Washington.

DISEASES OF VEGETABLE CROPS

Vegetable diseases on the Chicago market in 1938 were reported by G. B. Ramsey (Plant Disease Reporter Supplement 114. September 15, 1939).

ALLIUM CEPA. ONION:

Botrytis sp., storage rot, in Massachusetts caused an estimated loss of 3 percent, much of the harvested crop was left out in fields in bags or crates subject to the weather, and the storage houses were warm during September and October, according to O. C. Boyd; neck rot in Wisconsin was more prevalent than for several previous years, causing a loss of 2 percent in yield plus 8 percent loss in grade and storage. Neck rot caused by B. allii was reported much more prevalent than for several previous years in New York, "2 or 3 percent loss in several fields in Orange County in July. Later caused much loss there after August floods" (PDR 22: 277); Texas, in Dallas County; Oklahoma, in Pittsburg County; California, it has been observed in experimental plots in Berkeley during the past 3 years, and during 1938 was apparently responsible for the killing of every seed stalk in one plot of about 300 plants. Also, during 1938 it was abundant in seed fields near Santa Rosa, where it was more injurious than downy mildew (PDR 22: 428-429).

B. cinerea was observed in California in San Francisco Bay region during the past 3 years, but did not appear to be serious (PDR 22: 428-429).

B. squamosa, sclerotial neck rot: According to Wiant and Bratley, a small amount of this disease was noted in a carlot of onions received from Ohio in mid-October. Six percent of the onions were affected with decay at the neck (PDR 23: 67).

Colletotrichum circinans, smudge, anthracnose: New York, "Almost none"; New Jersey, "Only one report"; in a carlot of Michigan white onions received on the New York market in late October from 10 to 95 percent were affected with smudge (PDR 23: 67); in Wisconsin anthracnose was more prevalent than for several previous years, "Bad on sets, especially the white variety," according to R. E. Vaughan; in Kansas, Otto H. Elmer reported that smudge had been seen once. This is the first report from Kansas in the Survey files.

Fusarium spp., bottom rot, reported by O. C. Boyd, caused losses much greater this year in Massachusetts than normally. The abnormally wet weather and the practice of permitting onions to stand out in the field for weeks following pulling, no doubt were important factors in the widespread occurrence of the disease (PDR 22: 386). Storage rots caused an estimated loss of 2 percent in Massachusetts. Bulb rot was reported from Washington in Yakima County. In Michigan, bulb rots

caused by Fusarium and other fungi were much more prevalent than last year or for several previous years, "Following the mildew epidemic and the harvesting and storage of immature bulbs, storage rots caused heavy losses in storage rooms," estimated loss 10 to 15 percent. Bulb rot reported as due to F. cepa was prevalent in New Jersey in low areas flooded by excessive rains. F. vasinfectum zonatum f. 1 was less prevalent than for several previous years in Iowa, according to I. E. Melhus, total loss was estimated at 1 percent.

Macrosporium porri, purple spot: In New York A. G. Newhall reported "Always some on late crop in August."

M. sarcinula parasiticum, black mold, was reported from Hartford County, Connecticut; according to Charles Chupp, in New York the disease is "Always common in hot weather and as onions begin maturing, wherever grown."

Peronospora destructor, downy mildew, in Massachusetts was less prevalent than last year, but much more than during an average year, estimated total loss was 1 percent (PDR 22: 298, 334, 386); downy mildew in Connecticut was reported more prevalent than for several previous years. A. G. Newhall in New York reported the disease less than last year, but more prevalent than in an average year, "Common to severe even down in Orange County and in New Jersey, also in Madison County on early crop." The mildew was found fruiting on three small backyard plantings of top set onions in and near Ithaca on April 19. This is the earliest recorded appearance of onion mildew in New York (PDR 22: 124, 252, 277, 300); New Jersey, "Not very destructive"; the disease was very destructive in certain areas in Ohio this year, particularly in the Scioto Marsh, within 4 or 5 days practically all of the onions in the Marsh were badly affected (PDR 22: 344); Indiana reported scattered distribution. In many muck-land fields there was poor air drainage, estimated total loss 2 percent; in Michigan Ray Nelson reported as follows, "Outbreak severe and general, worse in older sections. Harvest 30 days earlier than usual due to premature killing of tops." Estimated reduction in yield was 35 percent, much more prevalent than for several previous years; in Wisconsin the disease was much more prevalent than last year owing to the cool, wet weather. R. E. Vaughan estimated a loss of 1 percent; California (PDR 22: 428-429).

Phoma terrestris, pink root: A. G. Newhall reported pink root always common on older muck soil in New York (PDR 22: 277); Texas, in Dimmit and Zavala Counties (PDR 22: 195); Indiana, in Steuben County; in Michigan, Ray Nelson reported pink root general in fields where onions had been grown continuously for many years. It was more severe in fields where mildew struck the earliest, estimated reduction in yield was 3 percent; in Iowa, according to I. E. Melhus, the disease was less prevalent than last year or in an average year, estimated total loss was 1 percent.

Urocystis cepulae, smut, in Massachusetts was mostly limited to the seed-onion fields; in New York it was said to be a major hazard in older districts but was well controlled by most growers with formaldehyde. There was a reduction in yield of 10 percent plus 2 percent loss in grade and storage, making a total loss of 12 percent; Indiana, in Steuben County; Michigan, more prevalent than for several previous years, "Distribution increasing but formaldehyde treatment generally used as control"; less prevalent in Wisconsin than for several previous years, "Formaldehyde drip used where known soil-infection occurs," 2 percent loss was estimated.

Bacillus carotovorus, bacterial soft rot, was very severe in New Jersey following hot, wet weather.

Heterodera marioni, root knot, in Wayne County, New York, was reported by Lloyd E. Curtis as causing rather serious damage, and the grower estimated a 30 percent reduction in yield as a result.

Yellow dwarf or mosaic (virus): Kentucky (PDR 22: 143); reported from Iowa as causing a trace loss.

Miscellaneous troubles: Blight (undet.) was widely prevalent and destructive to the crop in Texas. In many large fields every plant seemed affected, and the number of harvestable plants was reduced by 10 to 20 percent. The loss to the grower was even greater on account of the low quality of the plants harvested (PDR 22: 195).

Flood and hurricane damage in Massachusetts caused a total loss of 25 percent. For losses in New England, see Reporter 22: 390.

ALLIUM SATIVUM. GARLIC:

Species of Fusarium, Helminthosporium, and Melanospora were reported from Texas in Lavaca County.

Sclerotium bataticola, reported under the name of "smut": Texas, in Fayette and Lavaca Counties.

S. cepivorum, white rot, in California was reported as a serious disease at Moss Beach, San Mateo County, it caused a 75 percent loss in a field near San Juan, San Benito County. This was the first report from California (PDR 23: 36).

Bacterial soft rot and streak (undet.) were reported from Texas in Fayette and Lavaca Counties.

ANETHUM GRAVEOLENS. DILL:

Cercosporina anethi, leaf and stem blight, reported last year in Texas, was again severe this year. Some hundreds of acres were involved. Seed treatment experiments showed marked improvement in stand and growth of treated rows over the controls, but not complete control of the disease (PDR 22: 123-124).

APIUM GRAVEOLENS. CELERY:

Cercospora apii, early blight, was unusually severe in Massachusetts, particularly in unprotected plantings, according to O. C. Boyd, who estimated a total loss of 12 percent; Connecticut reported the disease more prevalent than last year or for several previous years in Hartford and Fairfield Counties; A. G. Newhall reported from New York that the disease was "Not as bad as last season because of more adequate warning to 100 growers in April whose seed was examined." O. S. Cannon reported about 30 to 50 percent reduction in yield of knob celery in Nassau County (PDR 22: 300, 333, 345); Virginia (PDR 22: 197, 333); in Florida, G. R. Townsend reported that blight was less prevalent than at any time in the last eight years, owing to the dry weather, a 5 percent reduction in yield was estimated; J. D. Wilson reported the disease in Ohio (PDR 22: 344); Indiana, in muck soils; Michigan reported a 5 percent reduction in yield, "Severe in Kalamazoo County in mid-season crop"; owing to the wet weather in Wisconsin the disease was reported more prevalent than last year or in an average year.

Fusarium apii and F. apii pallidum, fusarium yellows, was reported by A. G. Newhall in New York as "A little less severe than usual. Better distribution of rains kept soil temperatures down till mid-August"; in Michigan the disease was reported less prevalent than for several years, causing a trace loss. Ray Nelson reported losses were confined to plantings of Golden types, and were decreasing each year through more general use of resistant varieties; the disease in Indiana caused a loss of 0.5 percent; wilt caused by Fusarium sp. was reported less prevalent in Wisconsin than for several previous years.

Phoma apiicola, root rot: In New York, A. G. Newhall reported that the disease had not been reported on this season's crop, but was isolated from one cold-storage lot of celery last winter. Damping-off due mostly to Rhizoctonia, but some Sclerotinia, was observed in Florida, "Generally, treatment of seed and seedbed soil was not practiced." Rhizoctonia root rot was reported from King County, Washington by the State Department of Plant Pathology.

Sclerotinia sclerotiorum, pink rot, watery soft rot, storage rot: In Massachusetts, O. C. Boyd reported storage rot more prevalent than for several previous years; watery soft rot in New York was reported less prevalent, a trace was found in one field in September, according

to A. G. Newhall (PDR 22: 61); in Florida, W. B. Shippy reported pink rot much more prevalent than for several years. Cold weather injured the foliage, predisposing the plants to infection. "Disease described by growers as severe every 4 or 5 years. Spring of 1938 proved particularly costly to growers."

Septoria apii and S. apii-graveolentis, late blight, was reported from Connecticut in New Haven County; in Massachusetts it was unusually severe, particularly in unprotected plantings; in New York, "Not as much as usual--since growers have been having seed examined. Not serious in Nassau County, but present in some fields," 1 percent was the estimated total loss (PDR 22: 300); owing to the wet weather favoring the organism, there was severe infection in New Jersey; observed in Norfolk County, Virginia, for the first time in the last eight years (PDR 22: 197); R. F. Poole in reporting from North Carolina said, "This disease is so severe on this crop that no one has successfully grown celery in this State"; according to W. B. Shippy, in Florida none was observed or reported from the Sanford vicinity; E. W. Mendenhall reported the disease at Columbus, Ohio, probably due to watering and not rotating crops (PDR 22: 344); Indiana; late blight in Michigan was more prevalent than in 1937. Ray Nelson estimated a total loss of 30 percent. He stated that "Dusting and spraying by average grower was ineffective in 1938 due to frequent and heavy showers. Midseason crop badly damaged in Kalamazoo County. Well controlled with thorough and timely applications of 8-12-100 Bordeaux"; in Wisconsin, R. E. Vaughan reported late blight much more prevalent than in 1937 owing to the wet weather; Washington, in King, Lewis, and Spokane Counties; California (PDR 22: 191).

Bacterial diseases: Soft rot (Bacillus carotovorus) was reported more prevalent than usual in Massachusetts; in New York, Charles Chupp reported the disease often present in storage; Washington, in Lewis County; bacterial blight (Bacterium apii) was more prevalent in New York than in 1937 or in an average year, a trace loss was estimated (PDR 22: 345).

Heterodera marioni, root knot, was reported by W. B. Shippy as more prevalent in Florida than last year. Nemas are tolerant of a wide range of temperatures and moisture and were more prevalent in sandy soil--all varieties were susceptible. "Losses sustained mostly in seedbeds, ranging up to 100 percent. Usually, same areas used year after year for seed-beds"; it was also reported more prevalent in Michigan by Ray Nelson, "Occasional plantings affected, traceable mostly to infected seed-beds. Nemas survive here in muck soil out-of-doors."

Virus diseases: In New York, cucumber mosaic was reported by A. G. Newhall as being much more prevalent than in 1937, "Many fields in Wayne County showed more than a trace, and in two fields it ran up to 40 and 50 percent near one end. Specimen examined by Severin at Berkeley, California, and identified as cucumber mosaic." A trace loss

was estimated; the usual prevalence of southern celery mosaic was observed in Florida, "Proximity of *Commelina* and other mosaic and aphid hosts may have relationship where disease was more abundant"; Department of Plant Pathology reported mosaic and yellows in King County, Washington.

Non-parasitic diseases: Black heart in New York was reported by A. G. Newhall as occurring in Oswego, Wayne, and Monroe Counties. It was less prevalent than for several previous years, a trace loss was estimated. Cracked stem (attributed to boron deficiency) was less prevalent than in an average year in Massachusetts, there was only an occasional report of light injury, according to O. C. Boyd; crack stem in New York was more prevalent than last year, a trace loss was estimated. A. G. Newhall reported, "Shows up in certain areas, 50 percent in a few fields, often on new muck or deeply plowed muck, completely controlled by 15 lbs. of borax per acre"; Washington, in King and Pierce Counties. Bolting was reported by the Department of Plant Pathology, from King County, Washington. Chlorosis and dwarfing, as reported by Ray Nelson, caused an estimated reduction in yield of 5 percent in Michigan, "Heavy August rains damaged the mid-season and late crops in many fields. Muskegon County crop ruined by flooding of fields in August." An unusual occurrence of edema was found on California celery shipped to Rhode Island (PDR 23: 66).

ASPARAGUS OFFICINALIS. ASPARAGUS:

Botrytis cinerea, stem blight, was reported more prevalent in Massachusetts than for several previous years, 2 percent reduction in yield was estimated.

Colletotrichum sp., stem canker, was reported in Illinois by the Natural History Survey at Barry, Pike County, August 27; Puerto Rico.

Fusarium culmorum, stem rot, was reported by the Natural History Survey at Cobden, Union County, Illinois, August 3.

Phoma media, stem canker, was reported by the Natural History Survey at America, Pulaski County, Illinois, October 5.

Puccinia asparagi, rust, in Massachusetts was reported by O. C. Boyd as causing an estimated total loss of 4 percent; New Jersey in Cumberland, Middlesex, and Salem; Maryland estimated a loss of 2.5 percent; other States reporting the rust were Texas, Illinois, Wisconsin, and North Dakota.

Bacterial soft rot occurred in sprouts in the field in New York, according to M. F. Barrus.

BEAN. See PHASEOLUS.
BEET, GARDEN. See BETA VULGARIS.
BEET, MANGEL WURZEL. See BETA VULGARIS MACRORHIZA.

BETA VULGARIS. GARDEN BEET:

Actinomyces scabies, scab, was observed several times on specimens sent from Long Island and Ontario County, New York, according to Charles Chupp; in Wisconsin, R. E. Vaughan reported scab less prevalent than for several previous years; in New Jersey, "Not the cause of a great loss"; Washington, in Spokane County.

Cercospora beticola, leaf spot, was reported from Connecticut, Wisconsin, and Kansas, as more prevalent than in 1937, or in an average year; New York, "Always a little present"; the disease was severe in many plantings throughout New Jersey; Texas, in DeWitt and Lavaca Counties.

Peronospora schachtii, downy mildew, was reported from Coupeville, Island County, Washington, by the Department of Plant Pathology.

Phymatotrichum omnivorum, root rot. Texas, in Bell County.

Pythium sp., damping-off: New Jersey and Wisconsin.

Curly top (virus): Oregon and Washington (PDR 23: 107-112).

Black spot (non-parasitic) was observed in Wisconsin again this year even though the weather was cooler than in 1937. R. E. Vaughan reported that research on possible boron deficiency in soil is under way by Dr. J. C. Walker and assistants. Girdle (physiological) in New York was reported by Charles Chupp as possibly more severe than has ever been reported before. In a survey made by vegetable crop men, the trouble was widely scattered over the State, especially severe in Ontario County. Crown rot due to boron deficiency was reported from Whatcom County, Washington.

BETA VULGARIS CICLA. SWISS CHARD:

Cercospora beticola, leaf spot: In two fields in New Jersey, 100 percent infection was observed. Cracked stem due to boron deficiency in soil was reported by O. A. Reinking in New York.

BETA VULGARIS MACRORHIZA. MANGEL-WURZEL:

Cercospora beticola, leaf spot: In New York, Charles Chupp reported, "Always present where the roots are grown."

Phoma betae, crown and root rot: Washington, in Lewis County.

Vascular necrosis (cause uncertain): Washington, in Cowlitz County.

BRASSICA CAMPESTRIS. RUTABAGA:

Bacterium campestre, black rot, in Wisconsin was reported only from Washburn and Polk Counties, according to R. E. Vaughan.

Plasmodiophora brassicae, club root: Washington, in Skagit County.

Sclerotinia sp., pod rot: Washington, in Skagit County.

BRASSICA OLERACEA ACEPHALA. KALE:

Plasmodiophora brassicae, club root: In New Jersey, according to the Plant Pathology Department, severe infection was observed in two fields.

BRASSICA OLERACEA var. BROCCOLI:

Alternaria brassicae, leaf spot: In New York it was said by Charles Chupp to be more prevalent than usual, apparently following some malnutrition injury.

Bacterium campestre, black rot: In New York, according to Charles Chupp, black rot was reported a few times from Long Island; scattered distribution in Wisconsin; Texas, in Hidalgo County.

Phoma lingam, black leg: New Jersey, "Not the cause of great losses.

Plasmodiophora brassicae, club root, was present in New York occasionally.

BRASSICA OLERACEA BOTRYTIS. CAULIFLOWER:

Alternaria brassicae, black leaf spot, was more prevalent in Massachusetts, owing to the wet season. A. herculea, gray leaf spot, was reported with A. brassicae from New York as being more prevalent than for several previous years.

Fusarium conglutinans, yellows: New Jersey, in Morris County; in Michigan, less prevalent than last year and much less than in an average year.

Peronospora parasitica, downy mildew, was common in cauliflower seed-beds at Riverhead, Long Island, New York; New Jersey, severe infection in seed-bed.

Phoma lingam, blackleg, in Nassau County, New York, was quite prevalent--in some fields there was a 10 percent loss.

Plasmodiophora brassicae, club root, in Massachusetts was more prevalent than for several previous years, causing an estimated total loss of 4 percent; New Jersey, in Gloucester County.

Sclerotinia sclerotiorum, watery soft rot, caused a trace loss in New York, according to Charles Chupp.

Bacillus carotovorus, soft rot, was reported from New York by Charles Chupp as being more prevalent than usual (PDR 22: 299).

Bacterium campestre, black rot, in Massachusetts was reported by O. C. Boyd as causing 5 percent loss in Massachusetts, more prevalent than in an average year; in New York, Charles Chupp reported, "Mixed with malnutrition troubles, but again more destructive than usual--especially prevalent late in the fall"(PDR 22: 299).

B. maculicola, peppery leaf spot, was reported generally distributed in Massachusetts, and more prevalent than for several previous years; in New York it "Could not be found this season, even though isolations were made of material with symptoms resembling this disease. Phytomonas campestre was isolated each time."

Magnesium deficiency: Charles Chupp reported that "Some magnesium deficiency experiments had been conducted in Delaware. Apparently, the same trouble was present in a number of cabbage fields in southern Onondago County. One field of 6 acres was almost a complete loss." Potash deficiency (tipburn) was more prevalent than for several previous years in New York, a trace loss was estimated.

BRASSICA OLERACEA CAPITATA. CABBAGE:

Alternaria brassicae, black leaf spot, was reported by O. C. Boyd as causing a trace loss in Massachusetts; gray leaf spot, A. herculea, was reported from New York with A. brassicae, "Very serious in some fields following tipburn and other malnutrition injuries. Serious in fields in Nassau County following rainy spell in July" (O. S. Cannon); less prevalent in Wisconsin than for several previous years, according to R. E. Vaughan; Texas in Hidalgo and Cameron Counties; Washington, in Skagit and Pierce Counties.

Corticium vagum, wire stem: New York, in Nassau County a few growers had trouble with wire stem in the seed bed but it was not serious. In Niagara County one case of the disease in early cabbage was stopped by use of corrosive sublimate. Present in one field in Oswego County; also reported from New Jersey and Kansas on seedlings.

Fusarium conglutinans, yellows, in New York caused a trace loss, according to Charles Chupp, "Gradually spreading, but held pretty well in check by resistant varieties." The counties reporting the disease

were Nassau, Wayne, Monroe, and Niagara; R. A. Jehle reported yellows in Maryland more prevalent than for several previous years, a 5 percent total loss was estimated; in North Carolina, R. F. Poole reported that the disease caused heavy losses in mountains and in sandhill soils. Resistant varieties gave excellent results and were well adapted to those areas; Indiana, in Fulton County; in Wisconsin it was reported less prevalent than for several previous years, owing to the cool, wet weather; I. E. Melhus reported the disease less prevalent in Iowa than last year or in an average year, with a total reduction in yield of 2 percent; Nebraska, in Madison County, more prevalent than last year; Kansas, usual amount.

Mycosphaerella brassicicola, ring-spot, was reported by the Department of Plant Pathology from Washington in Spokane, Skagit, and Pierce Counties.

Peronospora parasitica, downy mildew, was more prevalent in Massachusetts than last year and much more prevalent than in an average year, causing a total loss of 0.5 percent, according to O. C. Boyd; in New York Charles Chupp reported a trace loss; New Jersey, "Unusually severe this year--increased in severity after long rainy periods"; in Florida, G. R. Townsend reported downy mildew severe on seedlings in fall during periods of warm weather, with night fogs; Texas, in Zavala, Dimmit, and Hidalgo Counties (PDR 22: 361).

Phoma lingam, black leg, was reported more prevalent in Massachusetts than in an average year, by O. C. Boyd; New York, "Rare up-State. One field in Onondaga County showed 1 percent loss from the disease"; more than usual was reported from Maryland, with an estimated reduction in yield of 1.5 percent; R. E. Vaughan reported that in Wisconsin less was observed than for a number of years, owing to the fact that better seed was being produced.

Plasmodiophora brassicae, club root, in Massachusetts, according to O. C. Boyd, was more prevalent than last year and much more prevalent than in an average year--total loss was estimated at 3 percent; New York, in Nassau County, club root appeared in scattered fields and occasionally caused severe losses. It was rather abundant in Wayne County. Charles Chupp reported, "About the same amount as usual. In some fields there was excellent control by the use of hydrated lime"; New Jersey, "Prevalent in several sections of the State"; Maryland reported a loss of 0.5 percent; Indiana, in Kosciusko County; in Wisconsin, R. E. Vaughan reported that more was observed than in a number of years, total loss was estimated at 1 percent; Washington, in Snohomish and King Counties.

Sclerotinia sclerotiorum, drop, caused a trace loss in New York, according to Charles Chupp.

Bacillus carotovorus, bacterial soft rot, in New York was reported by Charles Chupp as rather common following worm injury, during a wet spell in midsummer and hot week in October; in Kansas Otto H. Elmer reported the disease more prevalent than in 1937.

Bacterium campestre, black rot, in Massachusetts and Wisconsin was reported the same as last year, but more prevalent than in an average year. Estimated total losses were 3 percent and 1 percent respectively; in Connecticut and Iowa the disease was reported as more prevalent than during 1937. Iowa estimated a total loss of 8 percent; in New York, Charles Chupp reported that black rot "Became statewide late in the summer. Apparently there is some hidden source of inoculum, which must be discovered before full control measures can be put into effect" (PDR 22: 299); in New Jersey the disease was reported severe in some plantings; Maryland reported more than for a number of years, 1.5 percent total loss was estimated; in Louisiana, according to L. H. Person, the disease was observed causing a trace loss; in Texas, G. H. Godfrey reported that owing to a shortage of Washington-grown seed, black rot was abundant everywhere and was the cause of considerable economic loss (PDR 22: 122, 361); occurrence was reported from Indiana and Nebraska.

Heterodera marioni, root knot: Texas, in Hidalgo County.

Mosaic (virus) was again reported from Wisconsin with slight loss.

Oedema (non-parasitic--mechanical or physiologic): In New York, Charles Chupp reported that almost none was observed this season; occurrence was noted in New Jersey.

Tipburn (non-parasitic--potash deficiency): In New York, owing to heavy rains, tipburn caused much more injury than usual. Especially prevalent in the Cortland Valley, according to Charles Chupp.

BRASSICA RAPA. TURNIP:

Actinomyces scabies, scab: Occurrence reported in New Jersey.

Alternaria brassicae, black leaf spot, was observed in Massachusetts.

Bacterium campestre, black rot, was reported by O. C. Boyd as causing 4 percent loss in Massachusetts.

Cercosporella albomaculans, white spot, was also reported as causing 4 percent loss in Massachusetts; in New York the disease was reported once.

Colletotrichum higginsianum, anthracnose, was reported from Texas in Liberty County.

Peronospora parasitica, downy mildew, was reported from New Jersey in Essex County.

Phoma lingam, black leg, was reported as causing 2 percent loss in Massachusetts.

Plasmodiophora brassicae, club root, in Massachusetts was particularly severe in the southeastern section. According to growers, it has never been reported so damaging in past years. There was much less in Barnstable County than in Plymouth and Bristol Counties, according to O. C. Boyd, who estimated a total loss of 3 percent.

Brown center (boron deficiency in soil) was less prevalent in Massachusetts than for a number of years, owing to wet weather, also most of the land on Cape Cod and in Bristol County formerly affected was being treated with borax, according to O. C. Boyd.

BROCCOLI. See BRASSICA OLERACEA var.
CABBAGE. See BRASSICA OLERACEA CAPITATA.
CANTALOUPE. See CUCUMIS MELO.

CAPSICUM ANNUUM. PEPPER:

Alternaria sp., black spot, in New York was "Very common on Long Island, especially after plants had been injured by floods and bacterial leaf spot." Alternaria sp., fruit rot, was observed in small quantities in Massachusetts, also reported in Kansas.

A. solani, early blight, caused leaf spotting in seed beds in Florida.

Botrytis sp., gray mold, in New Jersey caused soft rot in many fields; California (PDR 23: 68).

Cercospora capsici, leaf spot, was reported from Florida as causing 1 percent loss; in Louisiana it occurred on Bell peppers, causing a total loss of 2 percent, according to L. H. Person.

Cladosporium sp., leaf mold, was reported from Texas, in Hidalgo County.

Colletotrichum sp., fruit rot, in New York was reported very common on fruit of peppers grown on Long Island.

Fusarium sp., wilt, in Louisiana caused an estimated total loss of 5 percent. "Numerous fields had losses of from 10 to 20 percent. Plants wilted at fruiting period" (L. H. Person).

Glomerella cingulata, anthracnose: In Massachusetts, O. C. Boyd reported anthracnose more prevalent than last year, and much more prevalent than in an average year, causing an estimated total loss of 5 percent; in Florida, G. F. Weber reported a total loss of 1 percent. G. cingulata and Colletotrichum nigrum in Louisiana caused a total loss of 3 percent, according to L. H. Person, who also reported one field of 7 acres of Bell peppers at De Ridder a total loss, and a heavy loss in numerous fields of Cayenne.

Phymatotrichum omnivorum, root rot: Texas, in Bell County. Damping-off (Pythium sp. and Rhizoctonia sp.) was reported by O. C. Boyd as more prevalent than in an average year, causing 2 percent loss. Rhizoctonia sp. caused damping-off in New Jersey, Delaware, and Texas.

Sclerotinia sclerotiorum, timber rot, was reported from Florida with usual prevalence.

Sclerotium rolfsii, southern blight, caused a trace loss in Louisiana. The most susceptible varieties reported were Bell, Cayenne, and Sport. Florida and Texas also reported the disease.

Bacterium solanacearum, brown rot, was reported from Florida, causing a total loss of 1 percent.

B. vesicatorium, bacterial spot, in Massachusetts, was reported more prevalent than last year owing to the wet season. "There was very little on fruit as usual--mostly on foliage"; New York reported a total loss of 5 to 10 percent of the Long Island crop; in Cumberland County, New Jersey, the disease was severe; in Florida Kelbert reported, "Practically all early fruit exposed to heavy rains and wind infected. Later setting of fruit not damaged." A 25 percent loss in grade was estimated; it was severe on sweet peppers in Cook County, Illinois (PDR 22: 367); scattered distribution in Wisconsin on red peppers, a trace was the estimated loss.

Heterodera marioni, root knot, was reported in Hidalgo County, Texas.

Virus diseases: B. F. Dana reported curly top in Oregon and Washington (PDR 23: 107-112). Mosaic caused an estimated total loss of 5 percent in Massachusetts, according to O. C. Boyd; very common in New York on Long Island; present in New Jersey but not severe; Kelbert reported mosaic much more prevalent in Florida this year than during 1937, "Field showing 100 percent infection was destroyed by heavy rains so no observations were made as to loss of yield"; Texas reported mosaic in Zavala and Dimmit Counties; usual prevalence in Kansas was reported by Otto H. Elmer. Spotted wilt was not observed again this season in New York.

Blossom-end rot (non-parasitic) in Massachusetts was reported by O. C. Boyd as less prevalent than for a number of years. He estimated a total loss of 5 percent; in Florida G. F. Weber reported 1 percent loss.

CARROT. See DAUCUS CAROTA.
CAULIFLOWER. See BRASSICA OLERACEA BOTRYTIS.
CELERY. See APIUM GRAVEOLENS.

CICHORIUM ENDIVIA. ENDIVE and ESCAROLE:

Corticium vagum, bottom rot, on escarole was more prevalent than for several previous years in New York. "Present to a limited extent in most escarole plantings on Long Island," according to O. S. Cannon.

Yellows (virus) was reported from New York with the usual prevalence by M. B. Linn, "Often severe when plantings are near weeds."

CITRULLUS VULGARIS. WATERMELON:

Colletotrichum lagenarium, anthracnose, was observed in two small plantings in Albany and Tompkins Counties, New York; R. A. Jehle reported 3 percent loss in Maryland; in Pennsylvania, A. H. Bauer reported a trace loss; in Florida M. N. Walker reported loss, owing to the extremely dry weather which occurred throughout the entire spring; Texas, in Leon County; the disease was also observed in Indiana, Iowa, and Kansas. In Iowa, S. G. Younkin reported a reduction in yield of 3 percent.

Fusarium bulbigenum niveum, wilt, was observed in Middlesex County, New Jersey; in Virginia, Harold T. Cook noted the usual amount, 5 percent reduction in yield; in Florida, M. N. Walker reported wilt more prevalent than in 1937. He remarked, "More old land planted in Leesburg section this year than usual. One field not planted in watermelons for 23 years showed 15 percent wilt"; Texas, in Anderson County; in Oklahoma, wilt was general and serious, according to K. Starr Chester; Vedder Wright in Indiana reported 1 percent reduction in yield; the disease in Iowa was reported by S. G. Younkin as less prevalent than during the previous year or in an average year, with an estimated reduction in yield of 15 percent; occurrence was noted in Nebraska, Kansas, and Washington.

Pseudoperonospora cubensis, downy mildew, was reported by Harold T. Cook from Virginia, where there was more than last year owing to frequent rains, the reduction in yield was estimated at 2 percent (PDR 22: 361).

Pythium seedling loss was estimated at 30 percent in Iowa by S. G. Younkin.

Sclerotium rolfsii, southern blight, was observed in Brazos and Grimes Counties, Texas.

Verticillium wilt and leaf spot was reported in New Hampshire by S. Dunn.

Bacillus tracheiphilus, wilt, was reported by R. A. Jehle from Maryland, where there was the same amount as last year (2 percent loss) but less than an average year.

CUCUMBER. See CUCUMIS SATIVUS.

CUCUMIS MELO. CANTALOUPE:

Alternaria sp., black mold blight, was reported from New Haven County, Connecticut, as more prevalent than for a number of years on Bender's Surprise.

A. cucumerina, leaf blight: In New Hampshire, leaf blight was reported by S. Dunn; the disease in Massachusetts was more prevalent than during 1937 and much more prevalent than usual owing to the rainy season; in New York the disease was much more prevalent than for several previous years, according to Charles Chupp, who estimated a total loss of 7 to 10 percent. The disease "Always began in part of field shielded by windbreak or weeds. Almost none in fields when every part was exposed to wind from every direction" (PDR 22: 299, 332); an estimated total loss of 2 percent each was reported from Maryland, Florida, and Iowa; in New Jersey the moist season favored the development of the disease; it was also observed in Indiana, Union County, Illinois, and Wisconsin.

Cladosporium cucumerinum, scab: In New York Charles Chupp reported, "Almost none."

Colletotrichum lagenarium, anthracnose, in Massachusetts, according to O. C. Boyd, was generally distributed and caused a total loss of 5 percent. There was a rainy season during June and July; New York reported much more than usual, estimated total loss was 2 to 3 percent (PDR 22: 299); Maryland, Minnesota, Wisconsin, and Kansas each reported anthracnose more prevalent than last year; in Minnesota Carl J. Eide estimated a total loss of 2 percent and remarked that the disease was "Found abundant in experimental plots located in muskmelon district and worse where melons were irrigated with sprinkler"; New Jersey, South Carolina, and Texas reported observations.

Erysiphe cichoracearum, powdery mildew, was "observed slightly late in season" in New York, according to Charles Chupp; Florida reported a total loss of 1 percent; Texas, observed in Brazos, Zavala, and Dimmit Counties.

Fusarium sp., wilt, in New York was reported by Charles Chupp as follows: "Gradually spreading in Ontario Lake District. Observed it

in Schenectady County for first time. Resistant strains are being bred"; F. bulbigenum niveum, wilt, was reported from New York by O. A. Reinking, who stated that specimens had been sent in from Schenectady and Lockport. F. bulbigenum niveum f. 2 in Minnesota was reported more destructive than for several previous years and was spreading and becoming more destructive each year, according to Carl J. Eide.

Mycosphaerella citrullina, stem canker, in New York, according to Charles Chupp, was "Much less than usual, since frequent rains eliminated sand-blowing injury and sun-scald."

Phytophthora sp., phytophthora rot, was noted for the first time on the New York market, where the melons were shipped from Colorado, Utah, and California (PDR 22: 404).

Pseudoperonospora cubensis, downy mildew, was reported more prevalent than usual in Connecticut, Massachusetts, Maryland, and Wisconsin. It caused an estimated loss of 10 percent in Massachusetts and 2 percent in Maryland; in South Carolina the disease appeared earlier than in 1937, and was severe on cantaloupes (PDR 22: 332-333); in Florida a loss of 1 percent was recorded; in Texas six counties reported the disease; it was observed in Iowa, but no loss was reported; California (PDR 22: 275-276).

Sclerotium rolfsii, southern blight, was reported from Texas, in Cherokee County.

Septoria cucurbitacearum, leaf blight, in New York was said to be found in a few plantings.

Bacillus tracheiphilus, wilt, in Massachusetts caused a total loss of 10 percent, according to O. C. Boyd; New York and Maryland reported more than usual; New Jersey reported, "General in several plantings but less than usual"; in Louisiana L. H. Person reported, "In a planting of 100 acres 25 to 30 percent of the plants were killed or wilting on June 3, 1938"; according to Carl J. Eide, two reports were received in Minnesota and there was probably a lot more; in Indiana Vedder Wright reported bacterial wilt generally distributed and a reduction in yield of 30 percent; S. G. Younkin in Iowa reported 4 percent reduction in yield, which is the same as last year; in Kansas the disease was not observed in 1938.

Heterodera marioni, root knot, was reported from Texas in Cherokee County.

Virus diseases: Curly top was reported from Washington by B. F. Dana (PDR 23: 110); in New York Charles Chupp reported mosaic was "Being well held in check up-State by careful control of weed hosts, only an occasional field was severely infected"; Maryland reported an estimated

reduction in yield of 3 percent; in Wisconsin R. E. Vaughan reported mosaic less prevalent than last year or in an average year; it was rather abundant in an experimental plot in the muskmelon district in Minnesota, according to Carl J. Eide, who estimated a total loss of 2 percent for the State; its occurrence was also reported from Iowa and Kansas.

CUCUMIS MELO INODORUS. HONEY DEW MELON:

Colletotrichum lagenarium, anthracnose, was found in abundance on Colorado Honey Dews on the New York Market. Inspectors had been looking for the disease for the past 7 years, but had never found it before on western melons (PDR 22: 405).

Phytophthora sp., phytophthora rot, was unusually serious on Colorado Honey Dews during 1938 on the New York Market (PDR 22: 405).

Pseudoperonospora cubensis, downy mildew, in South Carolina appeared earlier in 1938 than in 1937 and was severe on Honey Dew melons (PDR 22: 332-333).

Pythium sp. was the cause of 10 percent loss in Iowa again this year.

Verticillium albo-atrum, verticillium wilt: In California, B. A. Rudolph and W. C. Snyder reported that during 1938 a high percentage of Honey Dew melons was found wilting in the Milpitas section of the San Francisco Bay region. Cultures were made from the discolored roots and stems of specimens collected in August, and this organism was recovered consistently. This is the first report of natural infection of Honey Dew (PDR 22: 447).

Curly top (virus): Washington (PDR 23: 110).

Skin breakdown: California Honey Dew melons which arrived on the New York Market during late August and September showed an unusually large amount of surface blemishes (PDR 22: 405).

CUCUMIS SATIVUS. CUCUMBER:

Alternaria cucumerina, leaf blight, in New York was much more prevalent than for several previous years, according to Charles Chupp, who remarked, "Worst epidemic recorded for at least 25 years, and much worse on melons than on cucumbers"; R. A. Jehle also reported the disease much more prevalent in Maryland, where a loss estimate of 2.5 percent was given; in Wisconsin R. E. Vaughan reported the disease more prevalent than in 1937, owing to the wet weather.

Cladosporium cucumerinum, scab, was reported generally distributed in Massachusetts, causing a total loss of 5 percent; in New York Charles Chupp reported that owing to the high temperatures during July and August there was almost no scab until near the end of the season when cool weather was prevalent; R. E. Vaughan in Wisconsin reported that the disease was more prevalent than last year owing to the wet weather.

Colletotrichum lagenarium, anthracnose, appeared unusually early in Massachusetts and caused foliage injury in Bristol and other eastern sections of the State (PDR 22: 332); Charles Chupp reported that usually anthracnose is not common on cucumbers in New York but he saw one field in Schenectady almost completely destroyed by the disease; in Maryland R. A. Jehle reported an estimated total loss of 4 percent, which shows that the disease was much more prevalent than for several previous years; occurrence was noted in Florida, Wisconsin, and Iowa.

Erysiphe cichoracearum, powdery mildew, in New York was said to have caused only a trace loss; Florida reported 1 percent loss in grade and storage; K. Starr Chester in Oklahoma reported the disease common on greenhouse-grown cucumbers.

Mycosphaerella citrullina, gummy stem blight, in New Jersey has been observed in the same field for several consecutive years, according to the State Department of Plant Pathology.

Phymatotrichum omnivorum, root rot: Texas, in Bell County.

Pseudoperonospora cubensis, downy mildew, in Massachusetts, according to O. C. Boyd, caused a total loss of 10 percent; Stoddard in Connecticut reported the disease more prevalent than usual; Charles Chupp reported the disease very common on Long Island, New York, 3 to 5 percent was the estimated loss; in Maryland R. A. Jehle estimated 2.5 percent reduction in yield owing to the wet summer; in Virginia Harold T. Cook reported 15 percent reduction in yield, the weather was cool and rains frequent; in South Carolina George M. Armstrong reported that cucumbers were earlier than cantaloupes and Honey Dew melons, therefore were less seriously affected and the damage minimized by weak market conditions (PDR 22: 332-333); in Florida G. F. Weber reported a loss of 4 percent; downy mildew was also reported in the District of Columbia, Texas, and Wisconsin.

Sclerotinia sclerotiorum, timber rot, caused a trace loss in the greenhouses in New York but was rare, according to Charles Chupp.

Bacillus tracheiphilus, bacterial wilt, in Massachusetts was conspicuous and damaging, the total loss being estimated at 20 percent (PDR 22: 297); the disease in New York was more common than for several previous years, occurring mostly in the western part of the State.

Charles Chupp estimated a total loss of 0.5 percent; other losses were 3 percent in Maryland and 18 percent in Iowa. The disease was also reported from Texas and Wisconsin.

Bacterium lachrymans, angular leaf spot, caused a trace loss in New York, "Apparently temperatures too high at critical periods," according to Charles Chupp; a severe outbreak of this disease was observed at Ovid, Michigan, on seed cucumbers (PDR 22: 367); Florida, Texas, and Wisconsin also reported the disease.

Mosaic (virus): Charles Chupp reported that in up-State New York this disease was being held in check by adequate eradication of weed hosts, but on Long Island it has gradually reduced the acreage to almost one-tenth in 20 years; in New Jersey the disease was common in many plantings but less prevalent than usual; Maryland reported a total loss of 4 percent, 2 percent reduction in yield plus 2 percent loss in grade; C. A. Ludwig reported mosaic in Washington, District of Columbia; in Ohio the descase was especially severe this year, according to J. D. Wilson it caused the destruction of whole fields (PDR 22: 344); the usual prevalence was noted in Wisconsin and North Dakota, while Kansas reported more than last year.

CUCURBITA sp. GOURD:

Colletotrichum lagenarium, anthracnose: In New York Charles Chupp reported, "Present in one planting where varieties were long grown."

CUCURBITA spp. SQUASH:

Colletotrichum lagenarium, anthracnose, in New York was "reported once on Hubbard squash--all late fruit in one field was affected."

Erysiphe cichoracearum, powdery mildew, was "very severe in two plantings" in New Jersey; R. F. Poole reporting from North Carolina said, "This disease caused serious damage to the crop, especially to late plants"; Connecticut and Texas reported occurrence of the disease.

Fusarium spp., root rot, in Massachusetts was more prevalent than in 1937, and much more than in an average year, estimated total loss being 4 percent.

Phymatotrichum omnivorum, root rot: Texas, in Bell County.

Pseudoperonospora cubensis, downy mildew: Texas, in Bell County.

Septoria cucurbitacearum, leaf spot, in Massachusetts was more prevalent than last year owing to the wet season, 0.5 percent being the estimated loss.

Bacillus tracheiphilus, bacterial wilt, in Massachusetts caused a total loss of 20 percent, according to O. C. Boyd; New Jersey reported the disease very severe in two plantings.

Bacterium cucurbitae, bacterial blight, was observed on one farm in Monroe County, New York.

B. lachrymans, bacterial spot: Michigan (PDR 22: 367).

Virus diseases: Curly top was reported from Washington (PDR 23: 110, 111). Mosaic caused a total loss of 3 percent in Massachusetts. New Jersey reported its occurrence in Mercer County.

Yellows due to lack of lime was reported in New York.

CUCURBITA MAXIMA. WINTER SQUASH:

Bacterium cucurbitae, bacterial spot, was reported generally in Massachusetts, causing a total loss of 1 percent.

Mycosphaerella citrullina, vine blight, or wilt, in Massachusetts was more prevalent than last year and much more prevalent than in an average year.

Fruit decay in storage caused a total loss of 40 percent of the stored crop in Massachusetts; black rot (Mycosphaerella citrullina), 25 percent; Fusarium spp., 5 percent; Sclerotinia sclerotiorum, 5 percent; miscellaneous, 5 percent.

Curly top (virus): Oregon (PDR 23: 108).

CUCURBITA PEPO. PUMPKIN:

Erysiphe cichoracearum, powdery mildew, in New Jersey was reported very severe by the State Department of Plant Pathology; in North Carolina R. F. Poole reported, "The severity of this disease on pumpkin may be the cause of this crop failing to produce as well as it did many years ago."

Mycosphaerella citrullina, fruit rot, in New York was not reported this season, according to Charles Chupp.

Bacterium lachrymans, bacterial spot, was observed in Michigan (PDR 22: 367).

Curly top (virus): Washington (PDR 23: 107-112).

CUCURBITA PEPO CONDENSA. SUMMER SQUASH:

Cladosporium cucumerinum, scab, was common in Massachusetts, causing a total loss of 7 percent. Rhizopus sp., rhizopus rots, and Fusarium sp., fusarium rots, were reported in two lots of Texas squash shipped by boat in November, which contained 18 percent and 50 percent decay respectively (PDR 23: 68).

Pythium ultimum, fruit and root rot, of Zucchini and yellow crookneck pumpkin in California was reported by John T. Middleton (PDR 22: 367).

Sclerotinia sclerotiorum, blossom-end rot, was observed several times on summer squash in New York, according to O. S. Cannon.

DAUCUS CAROTA. CARROT:

Alternaria sp., leaf spot: Louisiana in East Baton Rouge Parish.

Cercospora apii carotae, leaf spot, was more prevalent in Massachusetts than during 1937, and much more prevalent than in an average year, a total loss of 5 percent being estimated (PDR 22: 334); in New York O. S. Cannon reported the disease "Common on late carrots on muck land, perhaps 1 or 2 percent loss. Common on early carrots in Nassau County--loss slight"; in Ohio leaf spot was common and caused considerable loss in plantings where sprays had not been applied (PDR 22: 198, 299, 344).

Macrosporium carotae, leaf blight, in Massachusetts and Connecticut was reported more prevalent than last year and much more prevalent than for several previous years, the loss in Massachusetts being estimated at 5 percent; in New York A. G. Newhall reported the disease "Common late in the season on muckland carrots, probably 3 to 5 percent loss in general. It caused death of tops on carrots maturing from July 15 to August 15 in Nassau County and was present to a limited extent during remainder of season"; New Jersey, "Very severe in several plantings in Middlesex County, also present in other counties"; in Texas, G. H. Godfrey reported that the disease was again almost universally present in the Rio Grande Valley. "In large commercial fields it was checked by applications by airplane of copper-lime dust applied in the early morning on the dew-covered plants" (PDR 22: 122); in Ohio the disease caused considerable loss in plantings where sprays were not applied (PDR 22: 344); Indiana reported it more prevalent owing to the warm weather and above-normal rainfall.

Sclerotinia sclerotiorum, root and storage rots: In Massachusetts O. C. Boyd reported a trace loss from storage rots, the wet growing-season was followed by a warm, damp fall; the usual prevalence was reported in New York by Charles Chupp.

Sclerotium rolfsii, southern blight, was reported from Texas in Brazos County.

Bacillus carotovorus, soft rot, was more prevalent than for several previous years in Massachusetts, 2 percent reduction in yield being reported, matured and stored carrots suffering the most loss; the disease was observed in New York and Texas.

Heterodera marioni, root knot, was reported from Middlesex County, New Jersey, by the State Department of Plant Pathology; Texas, in Hidalgo County; in Kansas Otto H. Elmer remarked, "Noted in same location of garden as reported in 1931."

Yellows (aster yellows virus): Charles Chupp reported, "Always a trace, but less than usual."

Girdle (cause unknown): Washington, in Spokane County.

DILL. See ANETHUM GRAVEOLENS.
EGGPLANT. See SOLANUM MELONGENA.
ENDIVE. See CICHORIUM ENDIVIA.
ESCAROLE. See CICHORIUM ENDIVIA.
GARLIC. See ALLIUM SATIVUM.
GOURD. See CUCURBITA sp.

HIBISCUS ESCULENTUS. OKRA:

Ascochyta abelmoschi, pod spot, was reported in Middlesex County, New Jersey, by the State Department of Plant Pathology.

Phymatotrichum omnivorum, root rot: Texas, in Bell County.

HORSERADISH. See RADICULA ARMORACIA.

IPOMOEA BATATAS. SWEETPOTATO:

Actinomyces sp., soil rot, or pox, was observed in Cumberland County, New Jersey; Maryland reported a 2 percent loss, which was more than last year; in Louisiana the disease was even more prevalent than last year, causing a total loss of 5 percent, according to L. H. Person, who remarked, "Total losses on some farms 8 to 15 acres. Many of these fields are being taken out of sweetpotato production"; Texas, in Cherokee County; in Kansas Otto H. Elmer reported 1 percent loss.

Ceratostomella fimbriata, black rot, was reported from Cumberland County, New Jersey, by the Department of Plant Pathology; Kirby and Burke estimated a trace loss in the field in Pennsylvania; in Maryland R. A. Jehle estimated a total loss of 7 percent, reduction in yield 1 percent, plus 6 percent loss in storage; in Louisiana, L. H. Person

reported, "Ten reported cars and possibly more developed black rot in transit. All of these cars were early-washed potatoes, and evidently became inoculated in the washing process from a few potatoes which were naturally infected in the field." Estimated field loss from the disease was 1 percent; Tennessee reported a 10 percent loss in the field; other field losses were: North Carolina 1 percent, Georgia 20 percent, Texas and Iowa traces; K. S. Chester reported the usual prevalence in Oklahoma and that black rot and wilt were their most serious sweetpotato diseases, the estimated field loss was 4 percent; Kansas reported 2 percent reduction in yield.

Corticium vagum, stem canker: According to Otto H. Elmer, stem canker was rather common in hotbeds in Kansas.

Fusarium oxysporum, surface rot: In Oklahoma surface rot was very common in stored and market sweetpotatoes. F. bulbigenum batatas and F. oxysporum, stem rot and wilt: In North Carolina R. F. Poole reported, "This disease gradually increases in importance if sweetpotatoes are planted continuously on the same soil. Resistant stock has reduced losses by this disease in some localities"; percentage losses estimated were: 7 in Virginia, 4 in Maryland and Oklahoma, 2 in Indiana, 5 in Kansas, and 20 in Iowa; Louisiana reported its occurrence.

Monilochaetes infuscans, scurf: R. F. Poole reported that the use of disease-free seed-stock and rotation of crops had about eliminated this disease in North Carolina; Maryland, Kansas, and Louisiana each reported a trace loss, Virginia 2 percent; it was also noted in New Jersey.

Plenodomus destruens, foot rot, was reported as causing a trace loss in Maryland and no loss in Iowa.

Pythium ultimum, mottle necrosis, caused a trace loss in Maryland, according to R. A. Jehle; in Iowa it was more prevalent than during 1937, estimated loss was 2 percent.

Rhizopus spp., including R. nigricans, soft rot, caused decay in seed bed in New Jersey; Iowa reported a reduction in yield of 8 percent; Kansas, 2 percent.

Mosaic (virus): A trace was reported in Iowa by I. E. Melhus; in Kansas the disease was observed only on Nancy Hall.

Heterodera marioni, root knot, in Oklahoma was serious in seed beds in Okemah, Okfuskee County, and generally distributed in the State.

Seed-borne diseases (various organisms): In North Carolina R. F. Poole reported, "Puerto Rico seed sources have been established where stock may be obtained free of Monilochaetes infuscans, Fusarium batatatis, Ceratostomella fimbriata, and Heterodera marioni."

KALE. See BRASSICA OLERACEA ACEPHALA.

LACTUCA SATIVA. LETTUCE:

Albugo sp., white rust, was reported by S. S. Ivanoff from Texas in Maverick, Zavala, and Dimmit Counties. This is the first report of white rust on lettuce to the Survey.

Botrytis cinerea, gray mold rot, in Massachusetts was reported generally distributed by O. C. Boyd, who estimated a total loss of 3 percent; in New York O. S. Cannon reported that the disease "Caused losses as high as 25 percent in some cold-frame lettuce." Average loss was not very great; "Prevalent in several fields" in New Jersey.

Bremia lactucae, downy mildew, losses in late crop were estimated at 0.5 percent in Massachusetts by W. H. Davis; in New York the disease was more prevalent than last year or in an average year. O. S. Cannon reported it "Very common in September in western New York. Common in coldframes in Nassau County"; according to the Plant Pathology Department of New Jersey, 40 percent of the plants in the coldframes died. Prevalent in several fields in Passaic County, following rainy period, also reported from Bergen County.

Corticium vagum, bottom rot, was reported from Massachusetts, causing a total loss of 3 percent; according to A. G. Newhall, in New York there was a reduction in yield of 10 percent--the disease was more prevalent than last year. "With the revival of interest in head lettuce, this disease is becoming more important again." O. S. Cannon said, "One field was almost a total loss because of bottom rot. Otherwise not very important in Nassau County"; in North Carolina R. F. Poole reported, "This fungus caused heavy loss of seedling plants before and after transplanting in the field."

Marssonina panattoniana, anthracnose, in New York caused much loss in one greenhouse in Monroe County, according to Charles Chupp; M. W. Gardner and J. B. Kendrick reported the disease "was observed on March 29 in a number of fields of early lettuce in the Salinas Valley, California, causing a total loss in some fields" (PDR 22: 125).

Pythium ultimum, damping-off: In North Carolina R. F. Poole reported, "This fungus caused widespread loss in both plant-bed and field."

Sclerotinia sclerotiorum, drop, caused an estimated total loss of 3 percent in Massachusetts; more prevalent in Connecticut than during 1937 or in an average year. Five counties reported it; always some reported in New York, "Losses as high as 50 percent of crop in Nassau County coldframe lettuce" (O. S. Cannon); New Jersey, in Passaic County; in Arizona A. G. Brown reported about 8 percent of crop affected in Salt River Valley, also present in Eloy district.

Septoria lactucae, leaf spot, was reported rare in New York.

Bacterium marginale, bacterial leaf spot, was reported as present in one field in New York, causing 2 to 3 percent loss.

Virus diseases: Big vein was observed in Richmond County, New York, but was not as prevalent this spring as in the past (PDR 22: 174); in Arizona J. G. Brown reported the disease "Worse in fields used for lettuce for several years." Mosaic was found in Connecticut in nearly all fields of New York varieties and to a less extent in Romaine. It seemed that the virus was present in the seed (PDR 22: 172); in Richmond County, New York, mosaic was not as prevalent as last year. The total amount of infection from both big vein and mosaic amounted to less than 2 percent. In Nassau County, according to O. S. Cannon, mosaic was responsible for the loss of 90 percent of the Romaine crop in two different fields at Hicksville. The average loss in Romaine lettuce to about July 5 was 10 percent.

Tipburn (non-parasitic) in New York was more prevalent than during 1937. A. G. Newhall reported that with renewed interest in Iceberg lettuce this disease is becoming more important, however, the disease was not very important in Nassau County during 1938; in New Jersey the State Department of Plant Pathology reported that tipburn was not the cause of serious losses, but some plants were rendered unmarketable; in Wisconsin the disease was reported much less prevalent than last year or in an average year.

Brown blight showed up on a few heads of lettuce in three different carlots from the Salinas district of California. This disease has not been seen often on the market during recent years (PDR 22: 406).

LETTUCE. See LACTUCA SATIVA.
LIMA BEAN. See PHASEOLUS LUNATUS MACROCARPUS.

LYCOPERSICUM ESCULENTUM. TOMATO:

Alternaria solani, early blight, was generally prevalent and destructive in many States. It was reported more prevalent than last year or in an average year in the following States: Massachusetts, Connecticut, New York, Maryland, Indiana, and Wisconsin. In New York Charles Chupp reported the disease very serious, in fact, worse than for a number of years, with a loss of 10 to 15 percent; New Jersey reported the disease prevalent with moderate injury; this was the most serious fungus disease affecting the crop in Florida. It caused slight to moderate damage to the earliest plantings and increased in severity gradually as the season advanced (PDR 22: 170); in Texas (Lavaca and DeWitt Counties) early blight was by far the most common and most destructive disease. Losses as high as 75 percent were observed (PDR 22: 123, 342); it was

observed locally in Oklahoma; Indiana reported a total loss of 3 percent owing to abundant rain; Kansas reported the disease common in the Kansas River Valley. Other loss estimates were 10 percent in Massachusetts and Georgia, 7 percent in Pennsylvania (this included collar rot), 5 percent in Maryland, Tennessee and Ohio, 4 percent in Virginia, 1 percent in Louisiana and Iowa, a trace in North Carolina, Michigan, and Washington.

Alternaria tomato, nailhead spot, was reported as causing a trace loss in Florida, and 2 percent loss in Iowa.

Botrytis sp., botrytis stem rot, has been very severe on greenhouse tomatoes at Hampton Institute, Virginia, since the autumn of 1937; California (PDR 23: 68).

Cladosporium sp., green mold; California (PDR 23: 68).

C. fulvum, leaf mold, in New York was said to have appeared in a number of out-door plantings, which was unusual for this State. The disease is always present in the greenhouse; in North Carolina R. F. Poole reported, "This disease was prevalent in fields throughout the State. This is the first report of its seriousness in the fields of this State"; in South Carolina G. M. Armstrong noted that plants were killed in the field by leaf-mold, this is the second season in the past 5 years that he has seen this occur in the field; according to G. F. Weber, leaf-mold in Florida was very prevalent on fall plantings, estimated reduction in yield was 1 percent; it was observed at various times during the season in Texas but the damage caused was only a trace, according to A. L. Harrison; in Ohio a considerable quantity of leaf-mold was found in one field at Hicksville, the seeds were sown directly in the field; R. E. Vaughan reported the disease was found only in greenhouses in Wisconsin, better adjustment of greenhouse ventilation was needed; in Kansas D. B. Creager reported that greenhouse specimens were brought in by John Miller from Turner and Pittsburg; Washington, in Pierce County.

Colletotrichum phomoides, anthracnose, or ripe rot: In New York C. O. Bratley and James S. Wiant reported, "More instances than usual of loss from anthracnose in New York State tomatoes were brought to our attention this season"; 7 percent of the fruits in a carlot of Tennessee tomatoes received in early July were affected with anthracnose; Indiana, "Found in direct-seeded fields in sufficient quantity to be of economic importance," estimated total loss was 3 percent; in Michigan a trace loss was estimated, and in Kansas 0.5 percent.

Fusarium bulbigenum lycopersici, fusarium wilt, is becoming less important commercially each year, owing to the use of resistant varieties. A small amount was reported from New York (PDR 21: 308); the Plant Pathology Department in New Jersey reported, "In Bergen County in a large planting 85 percent of the plants were affected. It has caused

complete destruction in a few fields in Burlington County"; the loss in Pennsylvania was estimated at 1 percent; Maryland reported scattered distribution, with a reduction in yield of 1.5 percent, whereas Virginia reported 10 percent, West Virginia 2 percent, Tennessee 2 percent, and North Carolina 4 percent; in Georgia a survey of about 30 tomato fields in Evans and Tattnall Counties showed the crop remarkably free from disease, partly due to dry weather (PDR 22: 198), estimated loss for State was 5 percent; Florida reported 2 percent reduction in yield (PDR 22: 171) and Louisiana 1 percent; wilt was observed in a number of fields in Texas but was serious in only a few fields. The planting of the wilt-resistant Marglobe reduced the losses (PDR 22: 343), the estimated reduction in yield for the State was 2 percent; Oklahoma and Ohio also estimated 2 percent; in Indiana wilt was observed in the southern half of the State; prevalence in Illinois was below normal; in Wisconsin the disease was not seen in the field and was minor in the greenhouses; Michigan, Minnesota, Iowa, and Colorado reported minor losses, while Montana reported 3 percent; in California wilt (_Fusarium_ sp.) was found in some of the patches of early staked tomatoes near Merced.

Nematospora coryli, yeast spot, was reported in Florida by G. F. Weber, causing a trace loss.

Phoma destructiva, black spot, in New York was less common than usual, causing a trace loss, according to Charles Chupp; in East Baton Rouge Parish, Louisiana, the disease appeared in fall tomatoes (L. H. Person); was present to the extent of 1 percent in Florida.

Phymatotrichum omnivorum, root rot, was observed in Bell County, Texas; also severely attacked tomatoes at Berwyn, Carter County, Oklahoma.

Phytophthora infestans, late blight, was not reported in Massachusetts, according to O. C. Boyd; it caused some loss in Nassau County, Long Island, New York, and was serious in several lots of western New York tomatoes shipped to the New York Market (PDR 22: 408); traces appeared in Pennsylvania, Virginia, Texas, and Washington; an outbreak of late blight was observed in a small field of tomatoes near Goulds, Dade County, Florida. The infection did not spread far and did very little damage except in this one field. Occurrence of late blight on tomatoes is very unusual for this area, according to George D. Ruehle (PDR 22: 171); in Wisconsin, "Not seen or reported"; late blight rot was found in several instances in California (PDR 23: 68).

Phytophthora parasitica, buckeye rot, was observed in Jamestown, Chautauqua County, New York; it was of minor importance in Maryland and Florida; in Texas some fields had 50 percent of the fruits affected, following the rainy period of late April and early May. The average loss was 2 percent (PDR 22: 343); in California M. W. Gardner reported as follows: "Late in the fall buckeye rot of tomato caused by species of

Phytophthora was present in the Brentwood district, in fruits lying on the soil in the irrigation furrows. Cultures of the *Phytophthora* were made by Dr. C. M. Tompkins and have been sent to Dr. C. M. Tucker for identification." This is the first report of this disease on tomato from California to the Survey.

Pleospora lycopersici, pleospora rot: California (PDR 23: 68).

Pythium sp., soft fruit rot, was observed in Texas at various times during the season, according to A. L. Harrison, but the damage caused was only a trace. *P. de baryanum*, collar rot, was observed at Modesto and Salinas, California.

Rhizoctonia solani, damping-off and rot: Soil rot was reported from Florida causing a trace loss and was observed in Texas in Cameron, DeWitt, and Lavaca Counties, causing slight loss; K. S. Chester reported one case of damping-off from Okmulgee, Oklahoma.

Rhizopus sp.: In California M. W. Gardner wrote as follows to the Survey: "In the canning tomato crop in Napa Valley and near Stockton the conspicuous yellowing of single shoots was not uncommon. This is caused by stem invasion by *Rhizopus* gaining entrance through the early-ripened fruit." *R. nigricans* was observed in Jim Wells County, Texas.

Sclerotinia sclerotiorum, timber rot, was said to be rare in greenhouses in New York; a trace was observed in Florida.

Sclerotium rolfsii, southern blight, appeared in Florida this year causing a trace loss; North Carolina estimated 1 percent reduction in yield; in Louisiana, L. H. Person reported, "In fields comprising 400 acres of late spring tomatoes 5 to 8 percent of the plants were killed by *S. rolfsii*"; Texas reported observations on both fruits and stems at various times during the season but the damage caused was only a trace (PDR 22: 343); in Indiana the disease was much less prevalent than in 1937, according to R. W. Samson.

Septoria lycopersici, leaf spot, in Massachusetts was more prevalent than in average seasons, estimated reduction in yield was 1 percent; Connecticut, usual prevalence; in New York the estimated loss was 1.5 percent; in New Jersey leaf spot was reported by the State Department of Plant Pathology as "More or less prevalent in many sections of the State"; Pennsylvania reported a reduction in yield of 3 percent; R. A. Jehle in Maryland reported the disease more prevalent than last year, causing 1 percent reduction in yield; Virginia and North Carolina also estimated 1 percent loss; Tennessee, 50 percent; Florida, trace, "Rarely found in the State"; Ohio, 10 percent, was very common and severe in certain fields; Indiana, 5 percent, it was found in direct-seeded fields in sufficient quantity to be of economic importance (PDR 22: 368). Much more prevalent than in 1937; Michigan estimated a total loss of 1 percent,

the weather favored the disease in the latter part of the season; Wisconsin, general distribution, more prevalent than last year, estimated reduction in yield 10 percent; Minnesota reported local distribution, estimated reduction in yield a trace; in Iowa S. G. Younkin estimated a loss of 4 percent, less prevalent than in 1937; Kansas reported a total loss of 5 percent, much more prevalent than last year and more prevalent than in average seasons; Montana reported 0.2 percent loss and Colorado a trace.

Verticillium albo-atrum, verticillium wilt: In New York O. A. Reinking reported specimens sent in from Lockport, Niagara County, "Soil heavily infested"; reported from Florida again this year causing a trace loss.

Heterodera marioni, root knot, in New York was slightly present in greenhouses, according to Charles Chupp. In Monroe County some nematode was reported on tomatoes of southern plant origin. Receivers of such plants were advised to refuse them. New York and Pennsylvania each reported 0.1 percent loss; Virginia, a trace; Tennessee, 2 percent; North Carolina, 5 percent; and Georgia, 2 percent; Texas, a trace (PDR 22: 123, 343). K. S. Chester in Oklahoma reported root knot very destructive at many locations in the shade, estimated loss for the State, 5 percent. Wisconsin, "Only in greenhouse-grown plants." Ohio and Michigan reported slight losses.

Aplanobacter michiganense, bacterial canker: New York, "In many fields in the western half of Chautauqua County a survey showed it only in fields where tomatoes were grown the previous year, 50 percent of the fruit was affected in most cases" (PDR 22: 198, 408); New Jersey, "Three infected fields in Cumberland County of the 81 fields inspected, 20 to 25 percent loss." Estimated reduction in yield for the State was only a trace; Harold T. Cook reported the disease not found in Virginia this year. The highest estimates reported were: Colorado 10 percent; Oklahoma and Wisconsin each 1 percent. The disease was widespread as usual, but losses caused were negligible.

Bacillus aroideae, bacterial soft rot, was reported from Cameron County, Texas.

Bacterium solanacearum, bacterial wilt, caused a trace loss in Massachusetts; reported from Jamestown, New York, "Possibly arrived on southern plants," no loss reported; Maryland reported a trace loss; in New Jersey the disease was favored by excessively wet weather; R. F. Poole, reporting from North Carolina, said, "This disease is becoming widespread in this State and all varieties are very susceptible. The Louisiana Pink shows some resistance," estimated loss 6 percent; in Indiana R. W. Samson reported bacterial wilt more prevalent than for several previous years--the disease apparently came in on southern-grown

seedlings (PDR 22: 331); southern bacterial wilt was the most common cause of tomato wilt in Illinois this season (PDR 22: 366); Virginia, Florida, and Oklahoma each reported 2 percent reduction in yield, and Ohio 0.5 percent.

Bacterium vesicatorium, bacterial spot, was not reported in New York this year, according to Charles Chupp; Maryland reported 0.5 percent loss; much less prevalent in Virginia this year than in 1937, estimated loss 2 percent; in Florida bacterial spot on the fruit caused "unusual infection, no doubt due to sand and water injury." Much more prevalent than last year or in an average year, loss in quality was estimated at 60 percent. All varieties were reported susceptible; the disease was observed in 3 counties in Texas (PDR 22: 343); Ohio reported the disease very common and severe in certain fields; Indiana reported it much more prevalent than last year owing to the heavy rain storms followed by frequent showers and nights with heavy dews, which made conditions favorable for the disease (PDR 22: 331); in Illinois bacterial spot on both leaves and fruit appeared generally distributed throughout the State. It caused extensive losses on early ripening fruit but was less destructive later in the season (PDR 22: 366); Michigan reported a reduction in yield of 0.1 percent; Wisconsin, Minnesota, and Kansas each reported a trace. In Minnesota the disease was common in Hennepin County; in North Dakota, W. E. Brentzel reported bacterial spot from Fargo, Cass County. This is the first report to the Survey from this state; bacterial spot was more common this year in eastern Nebraska than it had been for a number of years.

Curly top (virus) was reported from Texas, Washington--in 8 counties, Oregon, Montana, and Idaho (PDR 23: 107-112). Loss estimates were 25 percent in Washington, 15 percent in Idaho, 0.2 percent in Montana, and a trace in Texas.

Fern leaf (virus) was observed in Texas at various times during the season but the damage caused was only a trace.

Fruit mottle (virus suspected) was reported again this year from Texas (PDR 22: 173).

Mosaics (viruses mostly not distinguished) were generally reported but caused less damage than last year. Estimated losses were 2 percent in Virginia, Ohio, Louisiana, and Iowa; 1 percent in Massachusetts, New York, Pennsylvania, Maryland, North Carolina, Oklahoma, and North Dakota; 0.3 percent in Washington; 0.2 percent in Montana; 0.1 in Michigan; and a trace in Florida, Wisconsin, and Idaho. In New York Charles Chupp reported that the disease was "gradually being reduced by insisting on the destruction of weed hosts." In Indiana, according to R. W. Samson, "100 percent of plants were infected in 170 acres grown for canning and seed purposes by one canner. Infection was apparently traceable to plant bed." M. W. Gardner, in California, reported the extreme prevalence of

shoestring mosaic caused by a cucurbit virus near Brentwood and Byron. "The shoestring virus was apparently all of plant-bed origin and resulted probably from an unusual aphid infestation, as observed by our Entomology Division. This disease was the limiting factor in production in the late shipping crop of the Brentwood-Byron district. Affected plants produced no marketable fruit and one large field was abandoned in mid-season, since there was over 95 percent infection. That grower estimated that he lost $7000 in expenses on that field."

Ring spot (virus) in Indiana was reported by R. W. Samson as being less prevalent than last year in the southern part of the State.

Spotted wilt (virus) was not observed in New York in 1937 or 1938. The occurrence in an Ohio glasshouse-grown crop of tomatoes of a disease thought to be Australian "spotted wilt" is given in the Reporter (23: 105-106). The crop was severely damaged--50 percent reduction of crop from injury to plants and a large number of blemished fruits. Texas, Ohio, Michigan, and Wisconsin each reported a trace loss; in California M. W. Gardner reported, "There was less spotted wilt than in any of the last six seasons, even in the endemic centers of infection where it has always been fatal to tomato production."

Streak (virus) was reported from New York, Pennsylvania, Texas, Ohio, Michigan, and Wisconsin, with slight damage generally. Michigan reported the highest loss, which was 1 percent.

Blossom-end rot (non-parasitic) was prevalent in many States. State reports with comments follow: Massachusetts, general distribution, usual prevalence, estimated loss 2 percent; New York, according to Charles Chupp, "Rather serious on early pickings, but gradually became less as the season advanced"; New Jersey, "Severe on Bonny Best, 2 percent loss in some fields"; Pennsylvania, estimated loss 1 percent; Maryland, more prevalent than during 1937, estimated loss 1 percent; Virginia and West Virginia each reported an estimated reduction in yield of 3 percent; in North Carolina, R. F. Poole reported, "This disease continues to cause serious losses in the greenhouse and on many soil types," estimated loss for the State 2 percent; Georgia, 15 percent reduction in yield; Florida, 2 percent; Louisiana, Texas, Wisconsin, and Idaho each reported a trace; in Oklahoma the disease was "common in greenhouse tomatoes at Stillwater," estimated loss 1 percent; Ohio, North Dakota, and Montana also estimated 1 percent loss; Michigan, 0.1 percent loss; Minnesota, "No reports," disease was probably present; Iowa estimated 6 percent loss, which was less than last year; Washington, in Whatcom and Pierce Counties, estimated loss 0.3 percent.

Blotchy ripening (non-parasitic) in New York, according to Charles Chupp, is still a problem in some of the greenhouses, it was reported severe in Monroe County.

Catface (non-parasitic) was observed at various times during the season in DeWitt and Lavaca Counties, Texas, but the damage caused was only a trace (PDR 22: 343).

Oedema (non-parasitic) appeared in Brazos County, Texas.

Core rot (cause undetermined) in DeWitt and Lavaca Counties, Texas, was responsible for heavy financial losses to some of the shippers of greenwrap tomatoes during the first weeks of the shipping season. During the latter part of April and the early part of May some lots had as high as 20 percent of the fruits affected. Fortunately, the malady was very uncommon after the first of May (PDR 22: 343).

Sun scald (non-parasitic) was prevalent throughout central and southern Jersey, according to the State Department of Plant Pathology; Maryland reported a trace loss; in Texas it was serious late in the season in fields defoliated by Alternaria solani (PDR 22: 343).

Psyllid yellows (caused by feeding of tomato psyllid) was very severe in central and eastern Nebraska for the first time (PDR 22: 327).

MANGEL-WURZEL. See BETA VULGARIS MACRORHIZA.
MUSKMELON. See CUCUMIS MELO.
OKRA. See HIBISCUS ESCULENTUS.
ONION. See ALLIUM CEPA.
PARSLEY. See PETROSELINUM HORTENSE.
PARSNIP. See PASTINACA SATIVA.

PASTINACA SATIVA. PARSNIP:

Cercosporella pastinacae, leaf spot, was reported serious in Nassau County, New York, in early August, and more common in the State than usually.

Phoma nebulosa, crown rot, was reported in Pennsylvania by R. S. Kirby as being more prevalent than for several previous years; however, it caused only a trace loss.

Ramularia pastinacae, leaf spot, was said by O. S. Cannon to be serious in Nassau County, New York, in early August.

PEA. See PISUM SATIVUM.

PETROSELINUM HORTENSE. PARSLEY:

Cercospora sp., leaf spot, in Middlesex County, New Jersey, was prevalent in several fields, according to the County Agent.

Septoria petroselini, leaf spot, was present in Middlesex County, New Jersey; specimens were collected at Watsonville, Santa Cruz, California, by M. W. Gardner.

Yellows (aster yellows virus) was reported on Long Island, New York, according to Charles Chupp. Yellows (non-parasitic) was "not reported" from New York this year.

PHASEOLUS LUNATUS MACROCARPUS. LIMA BEAN:

Colletotrichum lindemuthianum, anthracnose: Older lima and snap bean foliage continued to show an increasing amount of infection due to anthracnose at Riverhead, Long Island, New York (H. C. Huckett).

Diaporthe phaseolorum, pod blight, is becoming of common occurrence on lima beans on Long Island, New York, Charles Chupp reported it very severe this year, with a possible loss of 10 percent of the Long Island crop. Pod blight was found on the New York market during early September in a small amount in beans presumably originating in New Jersey; in Maryland R. A. Jehle reported a trace loss.

Erysiphe polygoni, powdery mildew, was reported in Virginia as more prevalent than for several years owing to the frequent rains. The disease is of no economic importance in Virginia and no loss was reported.

Root rots due to Fusarium spp. and other organisms caused a loss estimated at 2 percent in Maryland, which is the same as reported last year. Macrophomina phaseoli, ashy stem blight, was present in Dimmit County, Texas.

Phytophthora phaseoli, downy mildew, in New York appeared in localized areas in lima bean fields, but up to August had not become general (PDR 22: 299). Charles Chupp reported the disease "Very severe in lower sections of the fields on Long Island"; the New Jersey Department of Plant Pathology reported the disease severe in many plantings.

Rhizoctonia spp., seed and stem rot, occurred in Suffolk County, New York, and Clarke County, Washington. Uromyces phaseoli typica, rust, was reported from Maryland as causing a trace loss.

Bacterium phaseoli, bacterial blight, was noted in New York. B. medicaginis phaseolicola, halo blight, in Virginia was more prevalent than during 1937, owing to the frequent rains and cool weather--estimated reduction in yield was 8 percent plus 8 percent loss in grade. B. vignae, bacterial spot, as reported by Charles Chupp, was very severe on Long Island, possibly 10 percent of the crop was a loss; Maryland reported a total loss of 0.5 percent.

Heterodera marioni, root knot: Texas, in Hidalgo County.

Virus diseases: Yellow mosaic was reported from Texas in Zavala and Dimmit Counties.

PHASEOLUS VULGARIS. BEAN:

Cercospora columnaris, angular leaf spot, was collected again in 1938 on Indian Reservation in Cattaraugus County, New York, but was not found elsewhere in the State, according to Charles Chupp; in Florida G. F. Weber reported 1 percent loss in quality.

Colletotrichum lindemuthianum, anthracnose, was more prevalent than usual in most States reporting it. One of the contributing factors was the very wet spring and early summer. In New Hampshire the disease was observed at Concord on July 12; in Massachusetts it caused severe losses in both home gardens and commercial plantings, estimated loss for the State was 2 percent (PDR 22: 297, 332); Connecticut reported the usual amount; in New York, M. F. Barrus reported the disease present on pods in one field in Wayne County. Charles Chupp said, "It seems almost to be a disease of the past, because of clean seed and resistant varieties. A few cases observed where anthracnose was present. Especially severe in one field of French Horticultural in Erie County"; anthracnose was reported present in some plantings in New Jersey; Maryland reported a total loss of 2.5 percent, which is much more than was reported in 1937. Florida reported 1 percent loss in grade; according to R. E. Vaughan, anthracnose in Wisconsin was more prevalent than last year; the greatest loss, 3 percent, was reported from Iowa by I. E. Melhus; Otto H. Elmer reported the disease more prevalent in Kansas than last year; Oregon (PDR 22: 388); in California, William C. Snyder reported for the first time in the writer's knowledge bean anthracnose was found well developed on beans in California in a small garden patch of Refugee Green on the immediate coast at Pacific Grove (PDR 22: 367-368); Pennsylvania and Oklahoma reported an estimated loss of 1 percent on dry beans.

Erysiphe polygoni, powdery mildew, in Maryland caused a trace loss this year; it was more prevalent than last year in Virginia owing to the cool nights and abundant moisture in the form of rains and heavy dews. Harold T. Cook estimated a loss of 7 percent from reduction in yield and an additional 4 percent loss in quality; in South Carolina, C. F. Andrus reported a few isolated infections of powdery mildew (PDR 22: 171); G. R. Townsend in Florida reported the disease generally controlled with sulphur, estimated reduction in yield was 1 percent. The most resistant variety proved to be strains of Kentucky Wonder, while the most susceptible were Bountiful and Stringless Black Valentine; the disease occurred in Texas, in DeWitt and Lavaca Counties; reported by the Illinois State Natural History Survey at Westfield, Clark County, September 22. Losses to dry beans in Pennsylvania and Michigan were negligible; these were the only States to report losses on dry beans.

Fusarium spp., root rots, in Massachusetts caused a total loss of 4 percent, according to O. C. Boyd; other States reporting root rots were New Jersey, Maryland, and Iowa. F. martii phaseoli, dry root rot, on green beans was reported from New York, Pennsylvania, Maryland, and Virginia, causing a reduction in yield of 2 percent in each State; North Carolina reported 1 percent, and Wisconsin, Iowa, and Idaho each reported a trace. On dry beans the disease was reported from New York, Pennsylvania, Michigan, Wisconsin, Montana, and Idaho. Charles Chupp in reporting from New York remarked, "With longer rotations and the use of the more resistant varieties, root rot no longer seems to cause severe injury, except in an occasional field."

Phymatotrichum omnivorum, root rot: Texas, in Bell County.

Pythium ultimum, root and stem rot: Salinas, California (PDR 22: 355).

Rhizoctonia solani, stem canker, on green beans was reported as follows: New York, 0.2 percent reduction in yield; Pennsylvania, Maryland, Louisiana, Wisconsin, and Idaho, each a trace; Ohio and North Carolina, 1 percent; Virginia and Florida, 2 percent. In New York, Pennsylvania, Michigan, and Wisconsin slight losses were reported on dry beans.

Sclerotinia sclerotiorum, sclerotinia rot, in Massachusetts was much less important than for a number of years, no loss was reported; Florida reported the usual prevalence.

Sclerotium rolfsii, root rot, in South Carolina killed a very small percentage of plants in one plot in the early pod stage (PDR 22: 171). Florida reported the same amount as last year and Louisiana reported it more prevalent than for several previous years. Other States reporting were Pennsylvania, Virginia, North Carolina, and Tennessee.

Uromyces phaseoli typica, rust, was unusually prevalent in several regions, as may be seen from the reports abstracted as follows: Massachusetts and Connecticut, more prevalent than last year; New York, "Very severe on late-planted snapbeans on Long Island. Some fields plowed up without being harvested. It was found very sparingly on Red Kidney beans in Wayne County." Rust infection caused severe leaf damage in some bean fields in Nassau County (PDR 22: 331); New Jersey, "Bountiful was destroyed in most cases. The most severe case of rust on record in New Jersey"; Pennsylvania, more prevalent than for several previous years, estimated loss 0.2 percent; Maryland, usual prevalence, estimated loss a trace; Virginia, more prevalent than last year and much more prevalent than in an average year owing to abundant rains in spring, early summer, and fall, estimated total loss 10 percent (PDR 22: 331);

in South Carolina rust was present in small but well distributed centers of infection; Louisiana, "First recording of rust on bunch beans, Giant Stringless, in 8 years" (L. H. Person); Florida, "Average loss of 50 hampers per acre in affected fields. Controlled by sulphur in most fields," estimated reduction in yield 2 percent (G. R. Townsend). According to H. A. Edson, it was almost universal in the Homestead area. He also observed it on the more mature plantings around Lake Okeechobee (PDR 22: 61); Texas, in Lavaca County; Wisconsin, more prevalent than for several previous years, but no loss was reported, it occurred only on the late crop; Wyoming, "Found in Kentucky Wonder variety at Torrington State Farm and at Cheyenne Horticultural Station in a few uncommon varieties"; Washington, in Whatcom County; other States reporting losses were North Carolina, 2 percent; Tennessee, 1 percent; and Wyoming, a trace.

Bacterial diseases: Bacterium flaccumfaciens, bacterial wilt, was reported by J. H. Muncie as being less prevalent in Michigan than in 1937 (PDR 22: 141).

Bacterium medicaginis phaseolicola, halo blight, was reported as causing a trace loss in Massachusetts; in New York, "This disease was prevalent and caused probably 5 percent loss in the early crop of snap beans in Nassau County. In Suffolk County Bountiful beans became infected when planted near wax beans, all of which seemed infected. The disease was also severe in some upstate fields" (O. S. Cannon); Pennsylvania, Wisconsin, and North Carolina each reported 1 percent reduction in yield; in Virginia, halo blight was much more prevalent than last year or for several previous years. The cool weather and frequent rains favored the disease, loss estimated by Harold T. Cook was 15 percent (PDR 22: 197); South Carolina (PDR 22: 171); a bean field in Chatham County, Georgia, near Savannah, was badly affected with halo blight. All plants in an area of about 25 feet in diameter were either dead or badly blighted (PDR 22: 198); G. R. Townsend in Florida estimated a reduction in yield of 5 percent, "Outbreaks traced to lots of infected seeds produced in Wyoming"; in Louisiana, halo and common blight (B. phaseoli) combined caused 10 percent loss; in Ohio, Iowa, and Colorado, the combined losses were 5 percent, 4 percent, and 6 percent respectively; Texas, in Lubbock County; in Illinois, northern Indiana, and southern Michigan, halo blight was observed more generally later in the season but did not appear to be as destructive as B. phaseoli (PDR 22: 141, 366); in Nebraska the disease was said to be more prevalent than last year or for a number of years on green beans, especially on canning beans in Scotts Bluff County, estimated reduction in yield 60 percent. The most susceptible varieties were "Stringless Green Pod, Asgrow Stringless, and Landreth Stringless (damage occurred in this order)" (PDR 22: 345); G. H. Starr, in Wyoming, reported that the blight situation was much the same as last year. The estimated reduction in yield was 20 percent, with an additional 10 percent reduction in quality. The most resistant variety was the Kentucky Wonder; Washington estimated 0.3 percent loss.

B. phaseoli, common blight, was reported from 16 States. Percentage losses were: Nebraska, 9, on dry beans; Massachusetts, 2; New York, Maryland, Pennsylvania, 0.5; in Ohio, Louisiana, Iowa, and Colorado, common and halo blights combined, 5, 10, 4, and 6 respectively; Maryland, 8; Virginia, 1; North Carolina, 1; Idaho, trace; and Washington, 0.3.

B. solanacearum, wilt, was reported from Oklahoma by K. Starr Chester. This is the first report to the Survey from this State.

Heterodera marioni, root knot, was reported from Hidalgo and Lubbock Counties, Texas. Pratylenchus pratensis, meadow nematode, also occurred in Hidalgo County, Texas.

Virus diseases: Curly top was reported from Washington, in small experimental plots at Prosser on wax bean, causing a total loss, and on red Mexican bean, causing some injury (PDR 23: 111), total loss for State was estimated at 5 percent; Idaho reported 6 percent reduction in yield.

Mosaic was reported from 15 States and Puerto Rico. Losses in general were not serious as resistant varieties and clean seed are gradually reducing the disease. Losses ranged from a trace in some States to 5 percent in Idaho (PDR 22: 141, 172, 198).

Smelter injury caused by sulphur dioxide was reported from Pierce County, Washington.

Witches'-broom (cause unknown): Washington, in Spokane County.

PISUM SATIVUM. PEA:

Aphanomyces euteiches, root rot: Estimated percentage losses from this organism were: Pennsylvania, 5; Maryland, 4; Wisconsin, 3; Massachusetts, 2; North Carolina, 1; Michigan, 0.1; and Idaho, a trace. In Wisconsin, "Most canners avoided root rot by staying away from known infested soil."

Ascochyta blights: Ascochyta spp. were reported from Maryland by C. E. Temple as causing 0.3 percent reduction in yield and a trace in quality. A. pinodella: "A trace present" in New York; A. pisi: "A trace reported" in New York; the New Jersey Department of Plant Pathology reported its presence in experimental plots; J. H. Muncie in Michigan reported a trace loss. (See also Mycosphaerella pinodes).

Cladosporium myriosporum ?, leaf blight, in New York, as reported by M. F. Barrus, "occurs on leaves and stipules that appear to have been weakened."

C. pisicola, leaf and stem spot, in the Rio Grande Valley, Texas, was reported as occurring during the period of moist, cold weather in January on English peas in one portion of a 60-acre field. This constitutes the first report of this disease in Texas. The disease was checked before any great damage was done (PDR 22: 122); reported from Washington by the Department of Plant Pathology in 5 counties.

Erysiphe polygoni, powdery mildew, was reported from 10 States, but it was of little importance generally. The highest estimated loss was 2 percent in Ohio. Wisconsin reported it more prevalent than for several years, but not a factor on the commercial canning crop, only on the late market garden crop.

Fusarium sp., wilt, was reported by Charles Chupp as rather rare in New York. The Washington Department of Plant Pathology reported wilt in Snohomish and Clallam Counties.

F. orthoceras pisi, wilt, was recorded from 10 States, but was rather unimportant--the highest estimated loss being 5 percent in Massachusetts and 1 percent each in North Carolina, Oklahoma, and Wisconsin; other States reported less. The use of resistant varieties is increasing.

F. vasinfectum pisi, near wilt, was reported causing a reduction in yield of 2 percent in Wisconsin, a trace in Montana, and 0.5 percent in Washington.

F. solani martii f. 2, root rot, was reported from Shelby County, Texas. This is the first report to the Survey on this host from Texas.

Mycosphaerella pinodes, mycosphaerella blight, was reported causing losses as follows: Massachusetts and New York, 0.1 percent each; North Carolina, 0.4 percent; Wisconsin, a trace; and Washington, 0.5 percent. (See also ascochyta blights).

Peronospora viciae, downy mildew, was reported scatteringly in New York, with a loss of 0.1 percent; at Charleston, South Carolina, "downy mildew was observed March 25, in field plots of the U. S. Regional Vegetable Breeding Laboratory, occurring during a period of near drought (PDR 22: 173); Florida and Wisconsin estimated a trace loss, and Washington (Peronospora pisi), 0.5 percent.

Rhizoctonia solani, stem rot, occurred in 5 States, causing the following losses: Massachusetts, 4 percent; North Carolina, 1 percent; Montana, 0.1 percent; Idaho, a trace; and Washington, 0.5 percent.

Septoria pisi, leaf blotch, was not important in New York; reported from Wisconsin, but did not cause any loss.

Bacterium pisi, bacterial blight, according to Charles Chupp, was not found this year in New York; other States reported as follows: Massachusetts, 0.1 percent; Maryland, 0.2 percent; North Carolina and Oklahoma, 2 percent; Michigan, 1 percent; Wisconsin, Idaho, and Wyoming, a trace; Nebraska, in Saline County.

Mosaic (virus) in New York "Caused about 50 percent reduction in yield in Nassau County" (O. S. Cannon). Mosaic was not as severe in Suffolk County as in 1937 (PDR 22: 173); in New Jersey the disease was "Common wherever peas were grown, much less severe than in 1937"; traces of loss were reported from Pennsylvania, Wisconsin, Oklahoma, Montana, and Idaho; Washington, 0.5 percent.

Streak (virus) was reported as causing a trace loss in Wisconsin and 0.5 percent in Washington.

POTATO. See SOLANUM TUBEROSUM.
PUMPKIN. See CUCURBITA PEPO.

RADICULA ARMORACIA. HORSERADISH:

Albugo candida, white rust, was present in New York, but was not especially injurious; in New Jersey the disease was severe in two fields; in Illinois, H. W. Anderson reported white rust more prevalent than in 1937 or in an average year, causing a reduction in yield of 10 percent.

Ramularia armoraciae, leaf spot, was present rather generally in New York, according to Charles Chupp.

Bacterium campestre armoraciae was reported from Illinois. In the extensive East St. Louis horseradish area, the disease was so severe as to cause general withering of the leaves (PDR 22: 367).

Black root (undetermined) was reported from Washington in Spokane County.

RADISH. See RAPHANUS SATIVUS.

RAPHANUS SATIVUS. RADISH:

Actinomyces scabies, scab, was less prevalent in Wisconsin than for several years, according to R. E. Vaughan.

Albugo candida, white rust, in New York, was reported still troublesome in some greenhouses; in Wisconsin the disease was more prevalent than last year, but no loss was reported.

Peronospora parasitica, downy mildew, in New York, was "Very common on volunteer radish plants in many parts of the State."

Plasmodiophora brassicae, club root, in Massachusetts, according to W. H. Davis, was more prevalent in spots, it appeared the earliest he had ever seen it, and by September the diseased plants showed only as a soggy network in the soil, estimated loss 2 percent; in Wisconsin, club root was reported from a town in Racine County.

Pythium aphanidermatum, black root, was more prevalent in Wisconsin than in 1937, owing to the wet weather, according to R. E. Vaughan, who estimated the loss at a trace.

Soluble salt injury occurred in some greenhouses in Monroe County, New York.

RHEUM RHAPONTICUM. RHUBARB:

Phyllosticta straminella, leaf spot, was reported from New York by Charles Chupp, with the remark, "Always present wherever rhubarb is grown in the State."

Phytophthora sp., crown rot: In Kansas, Otto H. Elmer reported that crown rot was "Noted in one field where an area several rods in diameter had all plants of variety Ruby killed. None killed of variety McDonald which were growing in infested area"; Washington, in Walla Walla County.

Bacterial leaf spot was reported from Arkansas by V. H. Young, who said, "One of our fruit growers near Fayetteville has been growing his rhubarb from seed in order to avoid the phytophthora crown rot, which is extremely destructive in this locality. This year, however, he had a great deal of trouble with a severe leaf spotting." S. P. Doolittle identified the disease as bacterial.

Crack stem (boron deficiency) was reported from Washington in Pierce County.

RHUBARB. See RHEUM RHAPONTICUM.
SALSIFY. See TRAGOPOGON PORRIFOLIUS.

SOLANUM MELONGENA. EGGPLANT:

Alternaria sp., leaf spot: "Scattered infections in New Jersey," according to the State Department of Plant Pathology.

A. solani, fruit rot, in Massachusetts, was more prevalent than last year, according to W. H. Davis, who estimated a trace loss; New York, on lower, older leaves, according to Charles Chupp; Florida reported the usual prevalence.

Corticium vagum, stem rot, was reported present in plant beds in New Jersey.

Phomopsis vexans, phomopsis blight, was reported from Massachusetts by Davis; in New York the disease was "present in most eggplant fields in Nassau County but causing very little damage. In one variety test in Suffolk County, Florida, High Bush was almost free, but some new varieties with small plants and fruits showed almost 100 percent infection"; in Florida the disease caused a loss of 5 percent; reported from Texas in Hidalgo, Cherokee, and Galveston Counties; Wisconsin reported the disease more prevalent than for several previous years, owing to the wet weather--total loss estimated at a trace.

Phymatotrichum omnivorum, root rot: Texas, in Hidalgo County.

Verticillium sp., wilt, caused a loss of 15 percent in Massachusetts, according to O. C. Boyd. O. S. Cannon reported that in Nassau County, New York, all plantings of eggplant observed were infected with V. albo-atrum, and from 25 to 75 percent of the plants wilted or died as a result. Later, some of the plants recovered from the wilt to quite an extent, so the damage due to this disease was not so great as was at first expected (PDR 22: 334). There were "No resistant strains, though Florida High Bush was more successfully grown than Black Beauty"; in Florida G. F. Weber reported the disease, with the remark, "First authentic report of this disease on this host. Reported two years ago on tomato, which was the first report on any host in Florida."

V. dahliae was reported from Washington in Benton County. This is the first report on this host from Washington to the Survey.

Bacterium solanacearum, wilt, caused a reduction of 2 percent in Florida, according to G. F. Weber.

Heterodera marioni, root knot, was reported from Texas in Cherokee County.

Mosaic (virus): Massachusetts.

Yellows (virus): Texas, in 7 counties.

Chlorosis (non-parasitic): Texas, in Bell County.

SOLANUM TUBEROSUM. POTATO:

For losses caused by potato diseases in the Hastings Section, Florida, in 1938, see Plant Disease Reporter 22: 272-274.

Actinomyces scabies, scab: In Vermont H. L. Bailey reported, "No real record, since there has been very little inspection. Nothing to indicate any unusual condition"; much less prevalent in Massachusetts than for several previous years, according to O. C. Boyd, who estimated a trace loss; in Pennsylvania the disease was more prevalent than in

1937 or in an average year, according to O. D. Burke, who reported, "Although the disease was present throughout the State, it was severe only where heavy liming had been practiced"; in Florida, "Common scab was widespread and caused increased damage this past season in spite of the more general use of one or more of the standard seed treatments. On farms showing a high percentage of scab infection in 1937, the disease was nearly as severe in 1938 although the seed had been treated, indicating that the organism was carried over in the soil" (PDR 22: 169). Michigan, Wisconsin, Minnesota, Iowa, and Kansas reported the disease less prevalent than last year. Loss estimates of 1 percent or more were: 10 percent in Michigan; 6 in Nebraska; 5 in Pennsylvania; Indiana, and Wisconsin; 4 in Iowa; 3 in Oklahoma; 2 in Vermont, New York, Maryland, and Virginia; 1.5 in Wyoming; 1 in Maine, West Virginia, North Carolina, Florida, Ohio, Minnesota, and Washington.

Alternaria solani, early blight, was widely distributed as usual, but not over 2 percent loss was reported from any one of the 24 States reporting. In Massachusetts O. C. Boyd reported early blight "Unusually severe in both early and late varieties toward end of seasons." It was considered worse than usual this year, particularly in Bristol County (PDR 22: 333, 415); Louisiana, a "Severe outbreak followed an unusual late cold snap, at which time the plants were slightly frosted"; early blight caused little damage in Florida (PDR 22: 169); in Texas the disease was somewhat irregular in incidence during the present season (PDR 22: 123); in Michigan the "Long growing season and above average rainfall was very favorable for infection. Some infection on tubers of late varieties"; according to Carl J. Eide, in Minnesota the disease was "more severe this year than for several years. As high as 20 percent of tubers were infected and developed rot in storage"; in Wyoming G. H. Starr reported, "Heaviest early blight I have seen in Wyoming during 7 year period, and the heaviest infection on irrigated potatoes. Slight on dry land"; New York (PDR 22: 252, 299); Virginia (PDR 22: 197).

Rhizoctonia (Corticium vagum) was widely distributed as usual but there was considerable variation in severity, as may be seen from the following estimated losses: 9 percent in Massachusetts; 5 in Vermont and New York; 4 in Indiana and Kansas; 3 in Minnesota and Iowa; 2 in Florida; 1.5 in Ohio and Wyoming; 1 in Pennsylvania, Maryland, Virginia, North Carolina, Oklahoma, South Dakota, Idaho, and Washington. West Virginia, Tennessee, Louisiana, Wisconsin, and Montana reported less than 1 percent loss.

Fusarium spp., wilt, was reported much less prevalent in Maryland than for a number of years, owing to the cool, wet weather, estimated loss was 1 percent (PDR 22: 418); Louisiana, trace loss; more prevalent than in 1937 or in an average year, "Seems to be on the increase," estimated loss 4 percent; Iowa, usual prevalence, trace loss; Kansas reported wilt less prevalent than for a number of years.

F. avenaceum, wilt, was said to be less prevalent in Wisconsin owing to the wet weather, estimated loss a trace.

F. oxysporum f. 1 and F. solani eumartii, wilts, in New York were reported causing a trace loss; wilts were much more prevalent in Nebraska than in 1937 or in an average year, estimated reduction in yield was 1 percent, with an additional loss in quality of 5 percent. This estimate of loss is based on 10,000 acres.

F. oxysporum f. 1, wilt, was reported as usual from Pennsylvania, causing a trace loss; in Michigan, J. H. Muncie remarked, "Too wet for severe damage in most areas";W. E. Brentzel in North Dakota reported the disease general as usual, causing a total loss of 1 percent; in Wyoming, G. H. Starr reported all commercial varieties susceptible, and estimated a 2 percent loss.

F. solani eumartii, "Z" wilt, was easily found in many fields in Monroe County, New York, and it appeared to be more abundant than last year, especially in sections where it had not previously been common (PDR 22: 299). Also reported from Cape Vincent, Jefferson County, by O. A. Reinking; C. D. Burke in Pennsylvania reported a trace loss; in Michigan, J. H. Muncie remarked it was "Difficult to estimate loss to crop at large, but was present in all commercial varieties to a small extent," he estimated a trace loss; in Wyoming, G. H. Starr reported wilt more prevalent than for several previous years in 5 counties, estimated loss was 4 percent. All commercial varieties were susceptible. "Differences in wilt susceptibility noted in several cases between strains of Bliss Triumphs. If not susceptibility differences, then the infection must have come through the seed, but authorities declare seed-piece dissemination not important."

Fusarium spp., dry rot, was reported from Massachusetts, New York, and Washington, and fusarium seed-piece rot from Florida.

Phytophthora spp. (including P. erythroseptica), pink rot and wilt, according to Reiner Bonde (PDR 22: 460) occurs to a limited extent each year in Aroostook County, Maine. The disease is generally found in land that is poorly drained. It was quite common in 1938, the season being characterized by rainfall that was considerably higher than normal. Losses were difficult to estimate, negligible during dry years, of importance in some fields if season is wet. Disease has been found to be soil-borne, persisting in soil for two or more years.

P. infestans, late blight: 1938 was probably the most favorable season for the development of late blight in the history of Aroostook County, Maine. Foliage infection in the field was observed the first week in July, and spread continued throughout the season. Control in the field seemed quite successful. Inspectors reported the greatest loss from decay in years. Total amount of loss from late blight decay was estimated at 5 or 6 percent of crop for the county (PDR 22: 458-459). Before the end of August in the northernmost section of New Hampshire, late blight infection was sporadic, but more than usually destructive

wherever present. In the mid and southern sections of the State late blight did not appear until after the heavy rains in September. Tuber infection was most severe in heavy soils and the low, poorly drained areas of fields. This was the worst blight year in New Hampshire in two decades (PDR 22: 413). In Vermont, in fields that were entered for certification, little blight was encountered. Apparently, a large part of the small lots of potatoes grown for home use were badly rotted. Farmers were said to be buying potatoes because their own were rotted in mid-fall. In Massachusetts, according to O. C. Boyd (PDR 22: 414), only in the southeastern section of the State was there appreciable loss prior to the onset of the fall wet weather in September. In the heavy-producing section of Bristol County, all unsprayed or poorly sprayed fields of all varieties were heavily damaged by blight on the tops during late June and throughout July. About the normal amount of infection occurred during August and early September: light to moderate injury on poorly protected crops, little or none in well-sprayed fields. The greatest losses were in gardens and small fields. (See also PDR 22: 297, 328.) Connecticut reported late blight more prevalent than last year, and much more so than in an average year, in Tolland, Hartford, New Haven, and Fairfield Counties. Late blight, although occurring in parts of New York State every year, developed into an epidemic during 1938. The disease appeared on Long Island in early June, and spread there to parts of the Island not usually affected. The average loss on Long Island was estimated to be not greater than 10 percent. In up-State New York, the blight began to be noticed in the southern tier of counties about the middle of July and by August 15 it could be found in practically every county in the State. County agents reported that in most counties 75 percent or more of the farmers did not spray or dust. For several years blight was a factor of little importance, which made them indifferent to the value of protection (PDR 22: 415-416). In New Jersey, according to Wm. H. Martin (PDR 22: 416-417), late blight was more prevalent than has been the case for the past 20 years. It was first observed in the vicinity of Cranbury on June 17 and was soon reported from all parts of the State (PDR 22: 301). O. D. Burke in Pennsylvania reported the disease much more prevalent than last year or in an average year. The disease was generally reported in all counties. Katahdin showed indications of resistance. Severe losses were experienced throughout the southeastern area of the State. The disease was discovered on June 20, which is believed to be the earliest recorded date for this State (PDR 22: 452). In Delaware, T. F. Manns reported somewhat of an outbreak of late blight (PDR 22: 417). In Maryland, R. A. Jehle (PDR 22: 417-418) reported that late blight occurred in potato fields throughout the State. It is usually confined to the western part where the elevation ranges from 1,000 to 3,000 feet above sea level. In that section it caused a loss of about 50 percent of the crop this year, owing to its early appearance and the difficulty of control. The disease was observed on Early Irish Cobbler potato crop on the Eastern Shore by Jehle for the first time since he came to Maryland in 1921. It appeared late in the season and did not cause much injury to the vines or

reduction in yield, but was responsible for severe losses from tuber rot. The estimated loss to Eastern Shore potato growers was 15 percent of the value of the crop (PDR 22: 406). In eastern Virginia, Harold T. Cook reported the "most severe epiphytotic on record for the spring crop. More severe than usual in the fall crop" (PDR 22: 196, 329, 419-420). In West Virginia, J. G. Leach reported late blight very prevalent and causing much damage. It was observed unusually early, on the first day of July the fields already being heavily infected (PDR 22: 420). In Tennessee, J. O. Andes reported that late blight destroyed a field of potatoes by May 30, the first time such a condition has been noted on the early crop in that State (PDR 22: 196). R. F. Poole reported, "This disease was observed to cause some damage to the crop in eastern North Carolina in 1937, and in this same area it caused severe damage in 1938 and was widespread over the entire area." In the Hastings section of Florida, A. H. Eddins reported the disease much less important than last year owing to the hot, dry weather during March and April (PDR 22: 61, 169). In the Rio Grande Valley of Texas, G. H. Godfrey (PDR 22: 122-123) reported that the outbreak of this disease during the present season, beginning the latter part of February and extending through March, was the worst that has occurred in the valley since 1931. For the first time in many years the disease extended beyond the more moist coastal county into the somewhat less moist Hidalgo County. In Ohio, according to C. C. Allison (PDR 22: 421), late blight was general this summer in the northeastern part of the State as far west as Hardin County. It was found around the Ohio River in Washington County on Cobblers doing considerable damage, which was very unusual for that section of the State. It did considerable damage on muck soil in Hardin County. Late-blight tuber rot was more prevalent than usual in Ohio. In Indiana, R. W. Samson reported the disease more prevalent than last year; "Scattered specimens were received from most parts of the State. There was some correlation with Maine-grown seed." J. H. Muncie reported (PDR 22: 421-422) that late blight appeared in Michigan following abundant rainfall at close intervals through July and early August. Unsprayed fields showed most damage. Losses ranging from a trace to 10 percent of the crop were reported from 14 counties, but average losses for the State were small. In Wisconsin, R. E. Vaughan reported (PDR 22: 422) that late blight appeared in Wisconsin in destructive amounts in August and September. The first appearance was noted in Oneida County August 12 and in Dane and Washington Counties August 28 to 29. Early varieties planted early in the season generally escaped infection. "The disease was most severe in the Milwaukee trucking area and on heavy soils in the north-central area (PDR 22: 342). In Minnesota, Carl J. Eide reported that late blight was much more prevalent than last year or in an average year. "It occurred in the east-central part of the State probably during the rainy weather of the first week in September. One lot of potatoes examined was badly decayed. The tubers had been sorted several times and only 6,800 bushels remained from a crop of 20,000 bushels." The disease was reported from Washington, in Snohomish, Pierce, Cowlitz, and Clarke Counties. Losses reported were: Maine, 10

percent; Vermont, 35; Massachusetts, 8; Connecticut, 10; New York, 45; Pennsylvania, 15; Maryland, 10; Virginia, 20; West Virginia, 10; Tennessee, 5; North Carolina, 3; Florida, 2.5; Ohio, 5; Indiana, trace; Michigan, 0.1; Wisconsin, 6; Minnesota, 8; Washington, 0.2.

Sclerotinia sclerotiorum, sclerotinia rot, in the Hastings section of Florida, was reported much less prevalent than last year, it was seen only in a few fields. "Bright days, little fog. Very light rainfall late in season, hot weather."

Sclerotium rolfsii, southern wilt, was reported much more prevalent in Florida than for a number of years. Estimated total loss was 1 percent. Louisiana and Texas also reported the disease. Iowa reported no loss.

Spondylocladium atrovirens, silver scurf: In New York, O. A. Reinking reported scattered distribution; in Pennsylvania, C. D. Burke reported the disease rather common, but losses were slight; Washington, in Whitman County.

Spongospora subterranea, powdery scab, was reported from Washington in King County.

Verticillium sp., wilt, occurred in Walla Walla County, Washington.

Bacillus carotovorus, soft rot, water rot: In the Dade County section of Florida, bacterial soft rot was of little importance except as a secondary condition following other infections, according to George D. Ruehle (PDR 22: 170, 193); in Michigan, J. H. Muncie remarked, "When coupled with deep scab and mechanical injuries, bacterial soft rot has developed with consequent losses of the crop"; Washington, in Island and Benton Counties.

Bacillus phytophthorus, black leg, was reported from 27 States. It was said to be more prevalent in Pennsylvania, Maryland, West Virginia, and Minnesota, and much more prevalent in Wisconsin than last year. Florida and Kansas reported much less, and North Dakota reported less than last year. The highest estimated loss reported was 5 percent for Georgia. Other States reporting 1 percent or more were: Maine, Virginia, North Carolina, Oklahoma, Wisconsin, Minnesota, Iowa, North Dakota, Idaho, and Wyoming, each 1 percent; Michigan, 1.5 percent; West Virginia, 3 percent; and Colorado, 2 percent.

Bacterium sepedonicum, bacterial ring rot (bacterial wilt and soft rot): Symptoms of this potato disease are given in the Reporter 23: 69-70. For occurrence in the United States--summary of literature and reports, see Reporter 22: 444-445. Wilt and soft rot of potatoes and the factor of seed transmission is given in the Reporter 22: 446.

Reiner Bonde reported (PDR 22: 459-460) that bacterial wilt and soft rot was first discovered in Maine in 1932. It appeared in epidemic proportions in some localities in 1937 and again in 1938. It was present mostly in the Spaulding Rose variety in 1937. Records showed that 315 acres, or 28 percent of the total acreage, of this variety entered for certification were affected. He gives a table which shows the amount of bacterial wilt and soft rot in lots of seed potatoes entered for certification in Maine in 1938. The disease was greatly reduced in the Spaulding Rose variety by planting disease-free seed stock. In 1938 it appeared mostly in Katahdin and to some extent in Green Mountain. "Approximately 800 acres were affected with wilt in 1938--total 140,000 to 160,000 acres"; in Pennsylvania, O. D. Burke reported that the disease appeared in three fields, where it was carried in the seed, estimated loss was a trace (PDR 22: 444); in the Hastings section of Florida, according to A. H. Eddins, "Rejection of severely infected seed stocks for certification in Maine and Canada prevented maximum losses in Florida. Only one Maine certified lot and a few Canadian lots were severely infected. Loss was confined mostly to uncertified Maine Spaulding Rose." Total loss was estimated at 1 percent; in Minnesota, Carl J. Eide reported, "The disease was found in lots from 6 growers in St. Louis County." Estimated total loss a trace; from Nebraska, R. W. Goss sent the "First report for the State" (PDR 23: 96); in Wyoming, on August 10, R. J. Haskell, George H. Starr, and Glen Hartman examined fields of a potato-grower at Powell in the northwestern part of the State. One field showed 25 percent of the plants with varying degrees of wilt. The seed from this Bliss Triumph field had come from a point near the Wyoming-Montana line two years ago (PDR 22: 445). The disease also occurred in Goshen, Albany, and Laramie Counties--estimated loss for State was set at 0.7 percent. Under dry-land conditions, according to G. H. Starr, there was very little infection; Colorado reported an estimated reduction in yield of 25 percent. According to P. A. Ark (PDR 23: 125), a bacterial ring rot of potatoes was found in potato tubers grown in California in 1938. Distribution and incidence of the disease in the State had not been determined.

Bacterium solanacearum, bacterial wilt, brown rot, was much more prevalent in Maryland than in 1937 or in an average year, according to R. A. Jehle, who estimated 1 percent loss (PDR 22: 418); Virginia, North Carolina, and Texas each estimated a 2 percent loss. In North Carolina, R. F. Poole said, "Potato is less susceptible than tobacco, but the disease killed the potato plants before good production was obtained"; in Florida, A. H. Eddins reported, "The disease was not as severe in the Hastings section as it might have been because the Katahdin variety was grown on the land most severely infested with the causal organism." Estimated reduction in yield was said to be 1.5 percent.

Seed piece decay (various causes) was not reported over as wide an area as in 1937. Its occurrence was observed in Erie County, New York; G. R. Townsend, in Florida, reported that early fall plantings

suffered from seed-piece decay when temperature was high and rainfall heavy. Estimated reduction in yield was 15 percent; North Carolina, Iowa, North Dakota, and Washington each reported 1 percent loss; Kansas reported less than last year, 1.5 percent.

Heterodera marioni, root knot, in New York, was reported as prevalent as usual, "Previously reported in Suffolk County, but not before in Nassau"; Texas, in Hidalgo County.

Virus diseases: Report of potato virus disease in 1938 is given by T. P. Dykstra in the Amer. Potato Jour. 16: 204-212, August 1939. Giant Hill was observed in Pennsylvania and Michigan, causing a trace loss. Leaf roll caused heavy losses in the 1938 potato crop. It was present in great amounts in Maine, occurred in epidemic proportions in 1938 as a result of an increase in the 1937 population of the peach aphid (PDR 22: 457-459); H. L. Bailey in Vermont reported 22 percent the maximum infection in any one field, "but probably ran much higher in fields not entered for certification. Only two or three in latter group ran over four or five percent--22 percent record was in Chippewa field" (PDR 22: 414); in Massachusetts, leaf roll was an outstanding disease this year in the Chippewa variety; a survey on Long Island, New York, of 393 fields showed an average of 10.4 percent infection; more leaf roll was observed in New Jersey this year than has been the case for a number of years, according to Wm. H. Martin. In some fields as many as 75 percent of the plants were affected. The most susceptible variety was the Chippewa. In spite of the prevalence of disease the average yield for the State was higher than usual (PDR 22: 416-417); more prevalent in Pennsylvania than for several previous years; in Maryland, R. A. Jehle reported losses from leaf roll were somewhat larger than usual, owing to planting much diseased northern-grown seed stock. Losses were estimated at 2 percent of the value of the crop from decreased yields and 0.5 percent of the value of the crop from failure of seed stock to certify (PDR 22: 418); in eastern Virginia Harold T. Cook reported leaf roll was especially prevalent in many of the fields in which Maine seed had been used. A survey showed that infection ranged from a trace to 75 percent of the plants in different fields (PDR 22: 420); in Dade County, Florida, Geo. D. Ruehle reported leaf roll was more common than in past seasons on farms that were planted to seed stocks originating in Maine and the Canadian provinces. In some fields 35 to 40 percent of the plants developed leaf roll and marked reductions in yield resulted (PDR 22: 169); Michigan and Washington reported its occurrence; Iowa reported a total loss of 7 percent; losses for other States were: Maine, 4 percent; Vermont, 5; Massachusetts, 4; New York, 2; Pennsylvania, 5; Maryland, 2.5; Virginia, 8; North Carolina, 1; Florida, 2; Oklahoma, 3; Texas, Idaho, and Indiana, each a trace; Ohio, 4; Michigan, 0.1; and North Dakota, 0.5. Mild mosaic was reported in about the usual amounts, except New York reported more than last year--2 percent loss, and Wisconsin reported less. Rugose mosaic was reported rare in fields of any commercial importance in Vermont; rarely seen in New York; in the

Hastings section of Florida, A. H. Eddins reported a total loss of 4 percent, "Loss was due to presence of disease in Spaulding Rose seed stocks. Affected plants in early plantings were severely damaged by freezing temperatures in January and either died or produced only a few tubers of marketable grades"; Texas and Michigan reported its occurrence. Common mosaic for the most part was reported without particular comment. Losses have been reported in Crop Losses (Supplement 118). Spindle tuber was reported from Maryland, Michigan, Wisconsin, Nebraska, Kansas, and Wyoming; the usual prevalence was noted in each State. Yellow dwarf: In Vermont, H. L. Bailey reported that no more than one or two plants were recorded this year; New York, Pennsylvania, Maryland, and Michigan reported a trace loss; according to R. E. Vaughan, in Wisconsin the disease was much less prevalent than last year. "Many carloads of new seed were used in sections where the disease was serious in 1937; yellow dwarf was present to some extent in the region north of Twin Cities, Minnesota (PDR 22: 422). This is first report to the Survey from this State. Veinbanding occurred in Benton County, Washington.

Blue stem (cause undetermined) was reported from West Virginia by J. G. Leach as being very prevalent in the region of Morgantown and vicinity--loss was estimated at 5 percent.

Purple top wilt (cause undetermined) was reported from Pennsylvania by O. D. Burke, who estimated 1 percent reduction in yield, and stated that "Stem-end discolorations of this type are rather common and tend to lower grades"; in Minnesota, J. G. Leach reported the disease again prevalent throughout the State but perhaps less destructive than it was in 1937. Spindling sprout was present in the seed, and many of the plants were grown from tubers produced on plants affected with purple top wilt in 1937 (PDR 22: 439); North Dakota reported purple top wilt much less prevalent than last year. An account of further experiments on the cause of "purple-top wilt" of potatoes was given by J. G. Leach in Phytopathology 29: 14, January 1939.

Hair sprout (undetermined) was reported by Eddins as much more prevalent this year than for several previous years in the Hastings section of Florida. "Only plantings made from one car of California White Rose developed hair sprout. This car came from Minnesota" (PDR 22: 168); L. H. Person in Louisiana estimated a total loss of 10 percent. "First outbreak of this trouble. Some fields had a loss of 40 to 50 percent in yield. Occurred in seed lots from North Dakota, Nebraska, Montana, Wyoming, Minnesota, and Wisconsin"; Wisconsin reported a trace loss, and Kansas 2 percent.

Hopperburn (caused by leafhoppers) and tipburn (non-parasitic) were generally reported less prevalent than last year. Only New York and Minnesota reported more; losses were 6 and 10 percent, respectively. For losses from other States see Crop Losses for 1938 (Supplement 118).

Psyllid yellows (caused by the potato psyllid) in southwest Texas, according to M. J. Janes (Jour. Econ. Entom. 32: 468. June 1939) caused severe injury to potatoes. "During the spring of 1938 every planting examined at Carrizo Springs was heavily infested with psyllids. Psyllid yellows, the disease for which these insects are responsible, was very much in evidence and in some fields 100 percent of the plants were severely affected. In the latter cases the crops were a total loss"; in Nebraska, James H. Jensen reported (PDR 23: 35-36) the disease caused widespread losses in the 1938 potato crop. In the western section of the State, where most of the commercial crop is produced, losses in individual fields ranged from none to slight or complete. In the irrigated areas in the western section, this early crop was especially seriously affected. The crop was not dug in some cases, owing to the low yields of yellows-diseased fields. The late season crop was also damaged in the irrigated section, but many growers were able to cut their losses by spraying with lime-sulphur for control of the insects. Losses ranged from slight to moderate in the early commercial potato crop section in central Nebraska, where most of the production is under irrigation. In the remainder of the State, where almost all potatoes are grown in small gardens for home use, the damage varied widely. In previous years psyllid yellows has usually been confined to the western portion of the State, this being the first year the disease has been found as far east as the Missouri River. In Nebraska this disease caused greater losses in 1938 than in any previous year (see also PDR 22: 327-328). O. H. Elmer reported no record of the presence of psyllid yellows in Kansas (PDR 23: 2). H. E. Morris in Montana estimated a reduction in yield of 25 percent from the disease (PDR 23:18, with map). In Wyoming the psyllid yellows was much more prevalent than in 1938 or in an average year, it was present in practically every field. G. H. Starr remarked, "The greatest loss was in early plantings and non-sprayed fields. Many fields were sprayed twice and needed another spray late in the season." It is estimated that for early-planted potatoes the loss was approximately 75 percent, and for the late-planted it was approximately 35 percent (PDR 23: 2-3). In 1938 Colorado experienced the worst outbreak of psyllid yellows in the history of the State, according to Leslie B. Daniels (PDR 23: 3-4). The epidemic was widespread, not only through the northeastern part of the State but through the mountainous sections, the San Luis Valley, and in Montrose County of the Western Slope (see county map of Colorado (PDR 23: 3, showing areas where psyllid infestations were observed in 1938). No heavy infestation occurred at Grand Junction where the disease was first noted in 1927. J. M. Raeder in Idaho estimated a trace loss. C. M. Scott reported occurrence of the disease in California (PDR 23: 4).

Smelter injury (caused by sulphur dioxide) was reported by the State Department of Plant Pathology from Pierce County, Washington.

Tubers but no tops (physiological) was also reported from Washington, in Walla Walla County, by the State Department of Plant Pathology.

SPINACH. See SPINACIA OLERACEA.

SPINACIA OLERACEA. SPINACH:

Albugo occidentalis, white rust, in the Winter Garden region of Texas, was by far the most destructive disease on spinach during the past season, as reported by S. S. Ivanoff (PDR 22: 194). Every spinach field examined had the disease, in many cases the infection was as high as 100 percent, and in a few cases the plants were so severely damaged that the fields were not harvested. The average yield was reduced by more than 25 percent. The Viroflay (flat leaf) variety was less damaged than the Bloomsdale Long-standing (savoyed) variety.

Colletotrichum spinaciae, anthracnose: Texas, in Zavala County.

Fusarium sp., wilt, was reported from New Haven County, Connecticut; in New York, O. S. Cannon reported it "Caused total loss of crop on several Long Island farms during the summer"; according to Harold T. Cook, there was a reduction in yield of 3 percent in Virginia, soil moisture was abundant. Crown rot in Maryland was reported by R. A. Jehle, causing a loss of 5 percent. F. spinaciae occurred in Dimmit County, Texas.

Heterosporium variable, leaf spot: New York, "Sometimes present following mildew"; Texas, in Zavala County.

Peronospora effusa, downy mildew, in Massachusetts, caused a trace loss, according to O. C. Boyd; in Connecticut it was found in about half of the fields observed, and in two of these considerable damage had occurred (PDR 22: 173); New York, "Present in the early spring crop on Long Island. Not observed in any plantings after July 1." Susceptible varieties were unmarketable; Maryland reported the usual prevalence, 1 percent loss; in Virginia, Harold T. Cook said, "Very little disease occurred in the spring crop, but a severe epiphytotic developed in November." Rains were frequent and dews heavy, estimated reduction in yield was 5 percent, with an additional loss of 10 percent in grade; S. S. Ivanoff reported the disease destructive in Texas, in some exceptional cases the damage to the crop reached about 30 percent (PDR 22: 195); in Washington the State Department of Plant Pathology reported the disease in Walla Walla County.

Puccinia aristidae, rust, was observed in Walla Walla County, Washington.

Rhizoctonia sp., damping-off: Texas, in Dimmit County.

Sclerotinia sclerotiorum, rot: New York, in Nassau County (PDR 22: 300).

Curly top (virus) in Texas began to appear in November and continued to appear on both old and new plantings up to the end of the season. An area of about four acres of spinach was destroyed almost entirely by this disease during the month of December, but the damage was light to the crop as a whole (PDR 22: 195); Texas, in Spokane County.

Mosaic (caused by cucumber virus): In New York, Charles Chupp remarked, "Resistant varieties are reducing the loss, almost none in Oswego County, where last year there was much of it"; Maryland, usual prevalence, 3 percent estimated reduction in yield; Texas, in Zavala, Maverick, and Dimmit Counties.

Damping-off in Nassau County, New York, caused losses as high as 90 percent. In some cases plants from red copper oxide treated seed damped-off as severely as plants from untreated seed (PDR 22: 299-300).

SQUASH. See CUCURBITA spp.
SWEETPOTATO. See IPOMOEA BATATAS.
SWISS CHARD. See BETA VULGARIS CICLA.
TOMATO. See LYCOPERSICUM ESCULENTUM.

TRAGOPOGON PORRIFOLIUS. SALSIFY:

Albugo tragopogonis, white rust: Apparently almost none this year in New York, according to Charles Chupp; Wisconsin reported scattered infection but no loss; Washington, in Whitman County.

Erysiphe cichoracearum, powdery mildew: New York, found in most plantings in the latter part of the season, according to M. B. Linn; it was reported from Benton, Washington.

Sporidesmium scorzonerae, leaf blight: New York, "Trace, in Wayne County in two gardens. Always present in all plantings in Richmond County. Bordeaux mixture gives promise of control. Foliage difficult to wet without wetting agent."

TURNIP. See BRASSICA RAPA.
WATERMELON. See CITRULLUS VULGARIS.

DISEASES OF SPECIAL CROPS

ALEURITES FORDI. TUNG-OIL TREE:

The following reports were sent in from Louisiana by A. G. Plakidas:

Dothiorella (Botryosphaeria) sp., nut rot, was reported in Washington, St. Tammany, and Tangipahoa Parishes but was less prevalent than in 1937.

Bacterium aleuritides, bacterial spot, was also less prevalent than last year. The disease was found in Washington and St. Tammany Parishes. White tree (genetic abnormality ?) was present in Washington, St. Tammany, and Tangipahoa Parishes. Crown girdle (undet.) caused a total loss of 0.5 percent. "Dothiorella sp. and Clitocybe tabescens found associated with the disease." Interveinal browning (undet.) was observed in Washington, St. Tammany, and Tangipahoa Parishes. Translucent spot (undet.) was found in Washington, St. Tammany, Tangipahoa, and East Baton Rouge Parishes.

ARACHIS HYPOGAEA. PEANUT:

Cercospora sp., leaf spot, caused heavy losses in Texas in Comanche and some adjoining counties (PDR 22: 361). C. personata was reported severe in one planting in New Jersey; in Virginia, according to Lawrence I. Miller, there was a total loss of 33 percent from the disease in the 6 leading peanut-producing counties (Surrey, Sussex, Greenville, Southampton, Isle of Wight, and Nansemond). "Results of experiments conducted in southeastern Virginia indicate that Cercospora leaf spot of peanut can be satisfactorily controlled with copper and sulphur fungicides. Leafspot control resulted in increased yield of hay and nuts"; R. F. Poole, reporting from North Carolina, said, "This disease caused severe premature defoliation and reduction in yield. Sulphur dust has given profitable control, increasing yield and forage."

Nut and root rots. Corticium vagum: R. F. Poole reported from North Carolina, "Five strains of this organism cause decay of plants. They are parasitic at different temperatures." Rhizoctonia root rot was observed at Atwood, Oklahoma, damage not serious. Fusaria: North Carolina, "A large number of Fusaria have been isolated from peanuts in the process of decay. A study of their parasitism at different temperatures indicates that many of them are causing decay." Sclerotium bataticola: North Carolina, "This organism is causing some decay of peanuts at high temperatures. It is widely distributed and is isolated from more than 75 percent of the nuts."

Phoma sp., leaf spot, as reported by Lawrence I. Miller in Virginia was "most prevalent in fields planted late. Seemingly, a greater percentage of infection in fields that had never been planted in peanuts before." It was only noted on runner varieties this season.

Sclerotium rolfsii, southern blight, Virginia (PDR 22: 452); in some fields in Texas the disease caused losses of over 50 percent, while other fields showed only occasional plants affected (PDR 22: 361).

Bacterium sp., nodules: In North Carolina, according to R. F. Poole, the tremendous amounts of nodules on roots in the Portsmouth soil may be the result of low yields. "Pop" (cause unknown): North Carolina, this disease of North Carolina runner and Virginia bunch caused heavy losses. The application of gypsum widely used by farmers for its control was effective (R. F. Poole).

GOSSYPIUM HIRSUTUM. COTTON:

Fungi appearing in cultures made from samples obtained during a seedling disease survey, reported by Paul R. Miller (PDR 22: 260-263), include Glomerella gossypii, which predominated, Fusarium moniliforme, Rhizoctonia solani, Fusarium spp., Pythium spp., Diplodia gossypina, Sclerotium (Rhizoctonia) bataticola, Fusarium vasinfectum, Sclerotium rolfsii, Aspergillus, and Alternaria. A similar survey was made for boll rots later in the season (PDR 23: 25-32), when Glomerella gossypii was again the predominating organism, and others found include Fusarium moniliforme, Fusarium spp., Alternaria, and Diplodia gossypina, together with some unspecified organisms.

Alternaria sp., blue stain, was reported from North Carolina by R. F. Poole. Other organisms were responsible for certain other stains. Ascochyta gossypii, blight on cotton leaves, was reported from Oconee and Pickens Counties, South Carolina (PDR 22: 324-325). Corticium vagum, damping-off and soreshin: Damping-off caused an estimated reduction in yield of 1 percent in Louisiana, "Always encountered in early plantings, especially in alluvial soils"; Texas, unusually heavy both in fields where seeds were treated, as well as where they were not treated (PDR 22: 245). In North Carolina R. F. Poole reported that seed treatment greatly reduced losses. Soreshin was reported from Texas (PDR 22: 245, 260-263).

Diplodia sp. following lightning injury was reported by Paul R. Miller from Georgia (PDR 23: 36); D. gossypina, pod blight, was reported by the Natural History Survey at Mounds, Pulaski County, Illinois, October 5. (See also PDR 22: 260-263; 23: 25-32). Fusarium moniliforme, boll rot and seedling root rot: R. F. Poole reported, "This organism continues to cause heavy losses. It is a more important parasite than we had expected"; according to Chester, boll rot was less prevalent in Oklahoma than last year; D. C. Neal reported seedling root rot caused a trace loss in Louisiana. (See also PDR 22: 260-263; 23: 25-32).

F. vasinfectum, wilt: Paul R. Miller reported observations on cotton wilt in relation to nematodes and certain mineral deficiencies in the Reporter, Vol. 23: 27-29. February 1, 1939. This includes a map showing counties surveyed for cotton wilt. Tennessee reported an estimated loss of 3 percent; in North Carolina, R. F. Poole writes that the disease is being satisfactorily controlled by using resistant varieties and applying potash to the soil, 7 percent loss was estimated for the State; estimated reduction in yield for Georgia was 5 percent; Louisiana estimated a total loss of 5 percent; in Arkansas, V. H. Young reported the disease more prevalent than last year or in an average year, 5 percent total loss was estimated; Texas reported wilt in six counties; Chester reported scattered distribution in Oklahoma, "Control demonstrations under way for 1939 in Hughes County, where individual fields showed 25 percent damage or more. Virtually 100 percent infection in some of these fields near Non." The reduction in yield for the State was estimated at 1 percent.

Glomerella gossypii, anthracnose and boll rot: Virginia experienced the wettest season in many years and losses ran high from seedling diseases and boll rot. Estimated reduction in yield was set at 15 percent; Tennessee reported 1 percent loss; North Carolina, 3 percent; Georgia, 0.1 percent; Arkansas, a trace; Louisiana, 3 percent, "Quite prevalent on seedlings in many localities, necessitating replanting. Only a few reports on boll rot." The anthracnose fungus was the most common organism associated with both seedling diseases and boll diseases, according to the results of surveys reported by Paul R. Miller (PDR 22: 260-263; 23: 25-32).

Phymatotrichum omnivorum, root rot, caused an estimated loss of 5 percent in Texas (PDR 22: 246, 359); in Oklahoma, K. S. Chester reported that Doctor Peltier mapped the infection area in Jackson, Tillman, and Cotton Counties for the Shelterbelt Service and they ran a line the complete length of the State to supplement his survey and to suggest future survey operations. The disease was found very destructive in many localities along the Red River. Reduction in yield was estimated at 3 percent; V. H. Young in Arkansas reported very small amounts in Little River and Miller Counties; Arizona (PDR 22: 380).

Puccinia schedonnardi, rust, was somewhat worse in southern Arizona than for several seasons--especially in Sahuarita and Continental districts (PDR 22: 380-382). Ramularia areola, frosty mildew: Texas, in Willacy County. Verticillium albo-atrum, Verticillium wilt: Tennessee and Texas reported traces; Arkansas, "Seen in Crittenden County, seemingly little damage"; reported by Natural History Survey from Cairo, Alexander County, Illinois, October 5. This is the first report to the Survey from Illinois; Arizona (PDR 22: 380).

Bacterium malvacearum, black arm, was more prevalent in Virginia than usual owing to the very wet and windy weather, which favored the spread of the disease. Estimated reduction in yield was 2 percent; Tennessee, North Carolina, and Georgia also gave an estimate of 2 percent loss; in Louisiana, D. C. Neal reported the disease more prevalent than for several previous years, "Seed treatment is apparently not controlling the disease in some localities. The disease became epiphytotic in parts of the Louisiana Delta this season"; Texas, trace (PDR 22: 245); more prevalent in Oklahoma than last year, estimated loss was 5 percent; less prevalent in Arkansas than for several years, according to V. H. Young; Arizona reported the disease worst in Eloy and Coolidge districts, but occasionally in fields throughout other districts (PDR 23: 32); New Mexico (PDR 23: 32).

Bacterium tumefaciens, crown gall; Oklahoma, Chester reported, "Specimen poor but according to Dr. Riker 'probably crown gall'--an unusual specimen--an unusual host." First report from State to the Survey on this host. Heterodera marioni, root knot nematode, was reported as causing a trace loss in Tennessee and Texas; 3 percent in North Carolina; and 2 percent in Georgia; in Oklahoma, root knot was "general, especially along river bottoms"; Arkansas estimated 1 percent reduction in yield; in Arizona, C. J. King reported several cases of rattooned Acala cotton adjacent to sugar beets infested, but plants were little injured (Salt River Valley).

Deficiency diseases: Potash deficiency caused a reduction in yield of 5 percent in sandy light soils of Louisiana. Arkansas reported 2 percent reduction in yield in the eastern sandy areas. Potash and magnesium deficiency caused "rust" in Oklahoma; in Virginia there was leaching due to the heavy rainfall.

Seedling blights caused by various organisms in Arkansas. "Difficult to make any estimate of loss. Seed treatments gave pronounced increases on early plantings indicating considerable damage."

HUMULUS LUPULUS. HOPS:

A note on hop anthracnose is given by John A. Stevenson in the Plant Disease Reporter, Vol. 22, pp. 125-126. May 1, 1938.

A report on hop anthracnose by G. R. Hoerner of the Division of Drug and Related Plants is given in the Plant Disease Reporter, Vol. 23, pp. 123-124, April 15, 1939. He listed specimens in their possession which had not previously been given careful consideration, since the disease is not common in the Pacific Coast hop-producing areas. He also contributed the following hop-disease survey in 1938; the variety is unknown unless otherwise stated:

Oregon:

Blight: Clackamas County, 1 report; Marion County 2 reports; Yamhill County, 2 reports.

Crown gall (Bacterium tumefaciens): Linn County, 2 reports, 1 on Late Clusters.

Dormant hills: Lane County, 1 report; Polk County, 1 report; Yamhill County, 1 report.

Downy mildew (Pseudoperonospora humuli): Lane County, 3 reports; Linn County, 2 reports, 1 on Early Clusters; Marion County, 2 reports; Polk County, 1 report; Washington County, 1 report; Yamhill County, 1 report.

Missing hills: Clackamas County, 1 report; Marion County, 2 reports; Washington County, 1 report.

Weak hills: Marion County, 1 report.

Washington:

Canker: Pierce County, 1 report on Fuggles.

Downy mildew: Pierce County, 1 report on Fuggles: Yakima County, 3 reports, 1 on seedlings.

Missing hills: Yakima County, 2 reports.

Sooty mould (Fumago ?): Benton County, 1 report; Yakima County, 1 report.

Virus: Pierce County, 2 reports on Fuggles.

Bacterium tumefaciens, crown gall, was reported from Yakima County, Washington, by the Department of Plant Pathology.

MENTHA spp. MINT:

Sphaceloma menthae, anthracnose: R. C. Baines reported that on July 29, many large fields of peppermint in northern Indiana were severely infected (PDR 22: 327). Puccinia menthae, rust, was more prevalent on spearmint than for several years in Michigan, while in Indiana it was conspicuous by its absence (PDR 22: 327). Verticillium sp., wilt, is increasing in prevalence, and is the limiting factor in production in many plantings.

NICOTIANA TABACUM. TOBACCO:

The following summaries of tobacco diseases for 1938 are given in the Reporter: Georgia (PDR 22: 295); Kentucky (PDR 22: 382-385); Florida (PDR 22: 204-205); Wisconsin (PDR 22: 250-251, 357-359).

Alternaria, Fusarium, etc., decay in curing. James Johnson and R. F. Vaughan reported that damage or decay in the form of stem-rot, pole-rot, and shed-burn was probably the worst on record in Wisconsin (PDR 23: 306). A. longipes, brown spot, according to J. A. Pinckard, was one of the most destructive and least recognized of diseases in the flue-cured counties of Virginia. The wet weather favored the disease. An estimate of 5 percent reduction in yield was reported.

Cercospora nicotianae, frog-eye, in Maryland, caused 1 percent reduction in yield. "Appears to give cured leaf green spots"; Virginia reported a trace loss in flue-cured counties; in Kentucky, frog-eye and green and black spot on cured tobacco, all caused by the above organism, were unusually prevalent in Burley tobacco in nearly all parts of the State, but loss from it was slight, according to W. D. Valleau and E. M. Johnson (PDR 22: 384); Tennessee, trace.

Fusarium oxysporum nicotianae, fusarium wilt: Maryland, estimated 1 percent loss; in Kentucky the disease was reported more frequently than in the past (PDR 22: 385). According to Valleau, fusarium wilt was prevalent in sandy soils along the Ohio River and in other areas. Most injurious to Burley. An occasional infected plant could be found in nearly any Burley field; Tennessee reported a trace loss; in Georgia, according to S. B. Fenne, the disease was not observed in the field (PDR 22: 295); it was found in new tobacco-growing areas in South Carolina (PDR 22: 326-327).

Peronospora tabacina, downy mildew, in Massachusetts, was more prevalent in 1938 than in 1937 and much more prevalent than in an average year owing to the cool rains in May and June. The disease appeared in the plant beds and in the field. First appearance was May 13 in Hampden County (PDR 22: 181-182, 297, 204, 251-252, 327); in Connecticut, P. J. Anderson reported that he found the first case of downy mildew on May 12, which was 14 days ahead of first appearance last year (PDR 22: 181-182); Pennsylvania reported it more prevalent than last year and much more prevalent than in an average year. "Appeared in beds (generally) at the close of setting season, resulting in very slight losses"; Maryland estimated a total loss of 12 percent. Weather conditions favored the disease. Drought occurred when the plants were very small, there was abundant rain for 2 weeks prior to transplanting and a cool period when plants were growing in the bed. Copper oxide-lethane spreader and cotton seed oil spray gave good control when properly used. Paradichlorbenzene was tried for the first time with favorable results. Benzol gas gave excellent results (E. A. Walker). Downy mildew occurrence was reported

in the southernmost counties on April 22, which is about 2 weeks ahead of the first observation last year (PDR 22: 128, 182); in Virginia, J. A. Pinckard estimated a loss of 10 percent on the basis of numbers of seedlings destroyed. The disease also caused losses in the field (PDR 22: 127-128, 203, 252); in Tennessee, near Nashville, downy mildew appeared three weeks ahead of any report last year. A second outbreak occurred in middle Tennessee following the cool, windy, and rainy weather starting about May 12 (PDR 22: 128, 182-184). A trace loss was estimated for the State; in Kentucky the disease was present in nearly all plant beds in the State. While it appeared to cause severe injury in many affected beds, there was no reduction in crop set, but the disease spread over all but far western end of State at about setting time. An occasional bed in the woods was destroyed. Growers and county agents reported that where Bordeaux mixture was used for leaf-spot control, downy mildew entered the beds a week to 10 days later than in untreated beds (PDR 22: 163, 184, 382, 384); this disease in North Carolina was much less severe in 1938 than in 1937. An abundance of plants were available without protection. Some growers actually inoculated plants to suppress growth brought on by early spring warm weather (PDR 22: 102, 116, 117, 127, 128, 182, 203); in South Carolina, the disease became general throughout the State, but did not cause severe damage. Owing to the extremely dry weather plants were very scarce (PDR 22: 102, 116, 117, 128); in Georgia, extremely dry weather set in and prevented a serious outbreak; however, the disease was present in every bed inspected. It usually appeared in unsprayed beds about 1 week earlier than in sprayed beds. It was a little more severe than average but not nearly as destructive as in 1937 (PDR 22: 60, 70, 88, 101, 115-116, 293-294); in Florida, during the 1938 season, downy mildew was first identified on February 7. Later, 7 beds with primary infection were found in 3 counties. All of these beds were on old sites where the disease occurred last year. Most of the plants were ready for transplanting before the general outbreak of the disease occurred; therefore, the attack was generally light (PDR 22: 70, 204-205).

Phytophthora parasitica nicotianae, black shank: In Kentucky, W. D. Valleau reported no infection in area where it had been present before; according to R. F. Poole, in North Carolina the disease was much more severe in 1938 than in 1937. Heavy losses in new fields were traced to infected plants in beds. The disease made its appearance near Greenville about 200 miles from the generally infested area; Georgia, trace found in a few fields inspected.

Pythium or Rhizoctonia, damping-off: Wisconsin (PDR 22: 250). Rhizoctonia, etc., soreshin, caused a trace loss in Massachusetts (PDR 22: 297); J. A. Pinckard reported 2 percent reduction in yield in the flue-cured counties of Virginia; Georgia.

Thielaviopsis basicola, black root-rot, was reported in Massachusetts by O. C. Boyd as worse than it has been in years. Estimated reduction in yield was set at 1 percent, while loss in grade and storage was

set at 13 percent, making a total loss of 14 percent; Pennsylvania reported a trace loss; scattered distribution in Maryland, less prevalent than for several previous years, estimated total loss 0.5 percent; Virginia estimated a trace loss in flue-cured counties only; in Kentucky, cool, damp weather at setting time favored the disease. The most resistant variety was Burley 16, which was widely grown, perhaps 100,000 acres in the State, estimated reduction in yield 1 percent (PDR 22: 384); the disease in Wisconsin was favored by the cold, wet soils, according to James Johnson and R. E. Vaughan (PDR 22: 358).

Bacterium angulatum, angular leaf spot, blackfire, in Massachusetts was worse in 1938 than for 7 or 8 years, especially in the 3 Connecticut Valley counties, total loss for the State was estimated at 5 percent (PDR 22: 182, 297, 325); the usual trace of loss was reported from Maryland; Virginia reported a trace loss for flue-cured counties; in Wisconsin, according to James Johnson, blackfire was the most common and conspicuous disease during 1938. It was found in practically every seedbed inspected in the State. Weather conditions favored both external and internal types of water-soaking (PDR 22: 250, 358).

B. solanacearum, bacterial wilt, caused an estimated reduction in yield of 1 percent in the flue-cured counties of Virginia; in North Carolina, R. F. Poole reported, "Wilt is becoming rapidly more widespread and is causing heavy losses. Rotation with corn that is well fertilized seems to be giving excellent reduction of losses"; according to S. B. Fenne, Granville wilt was not observed in Georgia this year (PDR 22: 295).

B. tabacum, wildfire, caused traces of loss in Massachusetts, while it was somewhat more noticeable than usual it was not so damaging as might be expected with the kind of weather that prevailed during June and July (PDR 22: 204, 325); in Pennsylvania, O. D. Burke reported the disease again very serious in Lancaster County. The estimated reduction in yield was 10 percent, and 3 percent loss in quality; E. A. Walker reported from Maryland that the disease was much more prevalent than last year. It caused a total estimated loss of 7 percent (PDR 22: 128); W. D. Valleau in reporting from Kentucky on B. tabacum, wildfire, and B. angulatum said, "Plant beds given 2 early treatments with Bordeaux produced crops which were nearly free of disease until after August 1, after which time it built up rapidly. Many fields from untreated beds were abandoned in July. Bordeaux appeared to give complete control of wildfire and angular leaf-spot in the plant beds." The diseases were much more prevalent this year than for several previous years. Reduction in yield of dark tobacco from the 2 diseases in the western part of the State was estimated at 60 percent, and 2 percent was the estimated loss in Burley for the State (PDR 22: 326, 382, 383); Johnson and Vaughan reported the disease more prevalent in Wisconsin than last year or in an average year (PDR 22: 250, 358).

Heterodera marioni, root knot nematode, caused a trace loss in Virginia in flue-cured counties, according to J. A. Pinckard; in some counties of Georgia, almost every field inspected showed some injury from nematodes. In certain fields as much as an acre of tobacco was completely ruined, and in some cases the crop was not even harvested (PDR 22: 205, 295); in Florida the disease caused severe loss in a tobacco bed in Suwannee County where sweet potatoes had been planted the year before (PDR 22: 205).

Brown root rot (undetermined) was severe in some fields in Kentucky and caused injury to the roots of plants in many fields where the tobacco had made fair growth (PDR 22: 384); Wisconsin reported an estimated reduction in yield of 2 percent. "Disease very conspicuous in early part of season, but frequent fair recovery later in season" (PDR 22: 358).

Frenching (non-parasitic) was observed in Maryland; according to E. M. Johnson in Kentucky, there was extensive injury from the disease in many fields in low areas and in recently limed fields or those bordering limestone roads (PDR 21: 326).

Potash deficiency: An estimated total loss of 1 percent was reported for Maryland; in the flue-cured counties of Virginia there was an estimated reduction of 1 percent in yield; in Kentucky W. D. Valleau reported that potash-deficiency was unusually prevalent all over the State. It was in some way associated with heavy rains. It caused reduction in quality in some fields (PDR 22: 326); the disease in Wisconsin was not as marked as in some years--it was seen only in about 12 fields.

Mosaic (virus): An estimated total loss of 7 percent was reported by O. C. Boyd from Massachusetts; in Pennsylvania, O. D. Burke reported the disease less prevalent than for several previous years, estimated total loss 1 percent; Maryland reported 3 percent reduction in yield and 3 percent loss in grade and storage, which was a little less than last year; in the flue-cured counties of Virginia, Pinckard estimated a total loss of 3 percent; in Kentucky, according to Valleau, "Mosaic caused burn of valuable top leaves of dark tobacco, because of spread at topping time. Some growers control it by eliminating use of barn-cured tobacco," estimated total loss 5 percent (PDR 22: 383); North Carolina reported the disease worse in some fields than during 1937. Farmers were giving much attention to its control; Georgia (PDR 22: 295); in Wisconsin the disease was more prevalent than last year, "About 25 percent of fields showed from 1 to 25 percent infection" (PDR 22: 359).

Other virus diseases: Ringspot in Maryland caused a total loss of 1 percent, which is the same as last year; Virginia reported a trace for flue-cured counties; the disease was more prevalent than usual in Kentucky (PDR 22: 383); in Georgia only 2 cases of ringspot were observed in flue-cured tobacco. Streak was fairly common in Kentucky, according

to Valleau and Johnson. Several severe outbreaks were reported in Owen, Carroll, Gallatin, and neighboring counties (PDR 22: 383-384). They also reported an undescribed virus-disease of tobacco which was observed in Monroe County, Kentucky (PDR 22: 384).

Miscellaneous troubles: In North Carolina, R. F. Poole reported cherry red (cause unknown) had been found to be an inherent disturbance; club root in Kentucky (PDR 22: 385); cold injury in Florida (PDR 22: 205); flood and hurricane damage in New England (PDR 22: 390); scald in Kentucky (PDR 22: 385).

DISEASES OF SUGAR CROPS

BETA VULGARIS. SUGAR BEET:

Actinomyces scabies, scab, caused a trace loss in Iowa, according to W. F. Buckholtz. Cercospora beticola, leaf blight, in Ohio caused a reduction of 8 percent in yield; J. H. Muncie reported from Michigan an average yield of 8 tons per acre, with a loss believed to be 1.5 tons per acre. Losses not consistently high. Estimated reduction in yield for the State, 15.5 percent; Wisconsin reported the disease more prevalent than last year owing to wet weather. A loss of 3 percent reduction in yield was estimated; in Iowa, Buckholtz reported the disease much more prevalent than last year. He estimated 10 percent reduction in yield. The following States reported traces: Texas, Wyoming, Colorado, Montana, and Washington.

Root rots due to various organisms were reported more prevalent than last year. In Iowa Aphanomyces cochlioides was said to be unusually severe, causing a reduction in yield of 15 percent. Phoma betae caused 0.5 percent loss in Ohio and Iowa, a trace in Wisconsin and Idaho, and 0.3 percent in Washington. Pythium, Rhizoctonia, and other organisms were associated in causing 1 percent loss in Michigan, where the disease was "worst on low, undrained soils, considerable variation in losses." P. aphanidermatum was observed in Santa Barbara County, California, and as yet is not widespread nor very important, according to John T. Middleton (PDR 22: 354-355). R. solani was reported as causing 1 percent loss in Iowa, and slight losses in Idaho and Washington. Sclerotium rolfsii: In Arizona, C. J. King reported several sugar beet seed fields in the Gilbert district, 20 miles east of Phoenix, severely infested with the disease. Brown reported this disease on Larkspur at Phoenix about two years ago, and later on sugar beets at Tubac in Santa Cruz County. The Salt River Valley now produces about half of the sugar beet seed planted in the United States (PDR 22: 257).

Montana reported a trace loss caused by the sugar beet nematode (Heterodera schachtii); a number of beet fields in Arizona were infested with the nematode H. marioni, according to C. J. King. Losses from curly top (virus) were reported as follows: Texas and Colorado, a trace; Montana, 6 percent; and Washington, 5 percent (PDR 23: 109). The year was considered one of moderately severe exposure in Idaho, Utah, California, and other sugar beet growing States in the curly top area. Savoy disease (virus) was found in Iowa, causing a trace loss. This is the first report of this disease to the Survey from Iowa. Heart rot (undetermined) caused a trace loss in Wisconsin.

SACCHARUM OFFICINARUM. SUGAR CANE:

P. J. Mills reported the following diseases from Louisiana; leaf spot (Cercospora sp.) found on C. P. 29-291; sheath rot (Cytospora sacchari), scattered distribution; red rot (Colletotrichum falcatum), less prevalent than last year. C. P. 28/19 was the most susceptible variety; pokkah bong (Fusarium moniliforme), general in distribution but less prevalent than last year; red stripe (Bacterium rubrilineans) and mottled stripe (B. rubrisubalbicans), only traces observed; root rot (Pythium sp.) less prevalent than for several previous years, "most of the varieties now being grown commercially are resistant to root disease"; red spot of leaf sheath (Sclerotium rolfsii), mostly in southeastern section of the State. Multiple bud (undet.) found on C. P. 29/116, C. P. 29/103, and L.O.J. 234; chlorotic streak (undet.) first found in Louisiana in the summer of 1937, and mosaic (virus) were listed as occurring on many varieties. In Florida, H. A. Edson reported the helminthosporium leaf spots of sugar cane, eye spot (H. ocellum), and brown stripe (H. stenospilum) were much in evidence at Canal Point (PDR 22: 61).

Rhizoctonia solani ?, banded sclerotial disease, was reported by T. C. Ryker from Louisiana. It occurred following a period of almost daily showers. "This is the first record of this disease in this country. The disease on sugar cane is associated with the presence of diseased Bermuda grass." He estimated a trace loss.

D I S E A S E S O F T R E E S

The following list of articles on tree diseases which appeared in the Reporter and the indexes to Volumes 22 and 23 of the Reporter supplement this summary.

Carter, J. C. Frost injury to woody plants in Illinois in May, 1938. 22: 434-435.

Hedgcock, George G. Notes on the occurrence of Coleosporium in the southeastern United States during 1938 and 1939. 23: 268-277.

Hoerner, G. R. The fungus flora of the Peavy Arboretum. 22: 264-267, 351.
Thompson, G. E. Notes on some tree diseases in Georgia. 22: 283-284.
U. S. Dept. Agr. Press Release. New tree diseases reduce food supplies of animals. 23: 46-47.
Waterman, Alma. Diseases of shade and ornamental trees: summary of specimens received in 1938 at the New Haven Office, Division of Forest Pathology. 23: 85-87.

CONIFERS

The very heavy snowfall of February resulted in extensive snow break in young stands of conifers in the Sierras and north Coast Range mountains of California. Aggregate damage to growing stock was very large. In addition to actual breakage many young trees were badly bent over and their usefulness destroyed. (J. L. Mielke, Division of Forest Pathology).

ABIES spp. FIR:

Fomes annosus, white spongy rot: One report from Hartford County, Connecticut on A. balsamea.
Lophodermium sp., leaf cast: Washington, in Stevens County.
Melampsora abieti-capraearum, rust, was reported on A. grandis in Blue Mountains, in Asotin and Garfield Counties, Washington, by the Department of Plant Pathology.

CHAMAECYPARIS spp. CYPRESS:

Phytophthora sp., root and crown rot, was found on C. lawsoniana and C. obtusa gracilis in Oregon (PDR 22: 302).

CRYPTOMERIA:

Twig blight (unknown): New York, in Westchester County, Long Island, reported by D. S. Welch.

JUNIPERUS spp. JUNIPER:

Cyanospora albicedrae, stem whitening: Texas, in Bell County on mountain cedar, J. communis montana.
Gymnosporangium clavipes, quince rust: Massachusetts; New York (PDR 22: 138, 150).
G. exiguum, cedar rust: Texas, in Anderson County.
G. globosum, hawthorn rust: Massachusetts; New York (PDR 22: 138, 150).
G. juniperi-virginianae, apple rust: Massachusetts; New York (PDR 22: 150); New Jersey; in Oklahoma K. S. Chester reported, "Very abundant on the coniferous host this year, but relatively little to be found on the pomaceous hosts as compared with 1937"; Texas, in Jefferson County; more prevalent than for several previous years on redcedar in Iowa; Illinois, on redcedar at Eichorn, Hardin County, April 26; Wisconsin, local distribution but more prevalent than last year on redcedar; Kansas, more prevalent than last year but less prevalent than in an average year.

Pestalozzia sp., stem and leaf blight: Texas, in Harris County.
Phomopsis juniperovora, nursery blight, was more prevalent than last year or in an average year in New York on Juniperus spp. and J. sabina tamariscifolia; in Oklahoma, Chester reported, "One of the factors in a rather common complex of juniper troubles. Other factors often associated are suppression, red-spider, frost cracks, and mechanical injuries. The whole complex badly needs study."
Die-back (cause unknown): Washington, in Adams County.

LIBOCEDRUS DECURRENS. CALIFORNIA INCENSE-CEDAR:

The incense-cedar dry-rot fungus rarely produces sporophores, but in 1938 the fruit bodies of this fungus were noted as unusually common over a wide range of the host. The deep snows of the preceding winter and heavy precipitation during the early spring months may possibly have been related to this relative abundance. (J. L. Mielke, Division of Forest Pathology).

PICEA spp. SPRUCE:

Chrysomyxa cassandrae, needle rust, was more prevalent than last year or for several previous years in Minnesota on P. mariana and P. pungens owing to excess moisture. "Uredinia found on Chamaedaphne calyculata, leather leaf, at Lake George, Hubbard County"; less prevalent than last year in Wisconsin on P. mariana.
Cytospora sp., canker: New Jersey.
C. leucostoma, canker, was reported less prevalent than last year and much less than in an average year on P. excelsa and P. pungens in Massachusetts.
Melampsorella cerastii, needle rust: A specimen on P. pungens was sent by P. A. Young from the mountain top near the Rio Grande Reservoir, Crede, Colorado, to Mycological Collections. "Pycnial stage causes extreme yellowing of needles of blue spruce."

PINUS spp. PINE:

Coleosporium solidaginis, goldenrod rust: New York, on P. resinosa.
C. vernoniae, rust: Serious infection on planted P. rigida in Illinois, reported by J. C. Carter (PDR 22: 433).
Cronartium sp., Woodgate rust, on P. sylvestris in New Hampshire.
C. coleosporioides, rust: Washington, in Whitman County.
C. fusiforme, rust, in southern pine. It has long been expected that the increase in oak and of the relatively susceptible slash and loblolly pines due to logging longleaf pine stands and to control of fire would result in an increased amount of the rusts that have oak and pine as their alternate hosts. Whether partly due to the above factors or mainly to weather conditions, there was much infection of 1-year-old pine seedlings in nurseries. Howard Lamb and Bailey Sleeth in 1938 in some nurseries found it involving as

high as 30 percent of the seedlings of slash pine (*Pinus caribaea*). This was much higher than had been found in 1937. (Howard Lamb. Rust canker diseases of southern pines. Southern Forest Experiment Station, Occasional Paper 72. Dec. 27, 1937.) Infection occurs during the first month at about the cotyledon whorl, and is detected at time of digging the stock in the fall as a slight swelling. Loblolly pine was generally less heavily infected than slash pine. Plantation infections were heavy in some places. (Carl Hartley, Division of Forest Pathology).

C. quercuum, pine gall rust: R. E. Vaughan reported it as follows on jack pine, *P. banksiana*, "Bad in State nursery at Wisconsin Rapids on 3-year transplants"; reported on planted *P. caribaea* and *P. taeda* and on native *P. echinata* and *P. virginiana* in Georgia (G. E. Thompson, PDR 22: 283).

C. ribicola, blister rust: Spread of white pine blister rust in 1938 (with map) is given in Reporter 23: 58-63. The disease was found for the first time on *P. strobus* in 1938 in Highland County, Virginia; Knox, Ashland, and Holmes Counties, Ohio; Chippewa, Montmorency, and Grand Traverse Counties, Michigan; Columbia and Juneau Counties, Wisconsin. Rust infection on Ribes in California showed that the disease had spread southward another 35 miles during 1938. No rust was found on sugar pine, *P. lambertiana* (PDR 23: 60-63). T. W. Childs, J. L. Bedwell, and G. H. Englerth reported blister rust infection on *P. albicaulis* in the Northwest (PDR 22: 139-140).

Fomes annosus was reported from Connecticut by Stoddard on *P. banksiana*, *P. densiflora*, *P. strobus*, and *P. sylvestris*; in Louisiana Paul V. Siggers reported the disease in a 9-year old plantation of *P. palustris* near Bogalusa, Louisiana.

Lecanosticta acicola (*Septoria acicola*), brown-spot needle blight: Texas, in Cherokee County on *P. taeda* (For note on perfect stage of this fungus see Phytopath. 29: 1076-1077. December 1939, by Paul V. Siggers).

Lophodermium sp., needle cast: New Hampshire.

Pythium and *Rhizoctonia*, damping-off, was much more prevalent in Wisconsin than last year owing to the wet weather.

Sphaeropsis ellisi, tip blight: In New Jersey on Austrian pine, *P. nigra*; Wisconsin, in Dane, Vernon, and LaCrosse Counties on *P. sylvestris*; Nebraska, on *P. sylvestris*, "first report for the State," also reported on *P. nigra austriaca*. Distribution and hosts in the United States are reported by Alma M. Waterman (PDR 23: 93-95).

PSEUDOTSUGA DOUGLASI. DOUGLAS FIR:

Phaeocryptopus (Adelopus): A species of Phaeocryptopus (Adelopus) apparently not greatly different from P. gäumanni was found in one locality in the coastal region of northern California. The fungus was causing no damage and probably is native to the region. (J. L. Mielke, Division of Forest Pathology).

Rhabdocline pseudotsugae, needle blight, was more prevalent on planted Douglas fir in New York during 1938 than for several previous years, according to D. S. Welch.

THUJA spp. ARBORVITAE:

Armillaria mellea, root rot: Texas, in Bell and Brazos Counties.

Coryneum sp., "Berckman blight," has become very serious in Oregon nurseries and gardens in recent years on varieties of T. orientalis (PDR 22: 302); Washington, in Pierce County.

Pestalozzia sp., die-back: New Jersey.

P. funerea, blight: Texas, in Johnson and Bell Counties.

Rhizoctonia sp., damping-off: Texas, in Harrison County.

HARDWOODS

ACER spp. MAPLE:

Cylindrosporium negundinis, leaf spot, on A. negundo in New York.

Gloeosporium sp., anthracnose: In Minnesota a few individual trees were infected owing to excess rain in the spring (C. M. Christensen).

G. apocryptum: New Hampshire (PDR 23: 85); in Massachusetts, W. H. Davis reported the disease prevalent in some localities, but less than in former years; observed on A. platanoides at Crescent City, Iroquois County, Illinois.

Nectria ditissima, canker, in Massachusetts was not so prevalent in some localities as in 1935 but was spreading (W. H. Davis); New Jersey, in Bergen County.

Phyllosticta minima, leaf spot, was reported from New York and Tennessee on Acer spp.; and on A. dasycarpum (A. saccharinum) and A. rubrum from Clarke County, Georgia.

Phymatotrichum omnivorum, root rot: Bell County, Texas.

Rhytisma acerinum, tar spot, was observed in New Hampshire, Wisconsin, and Iowa.

R. punctatum, tar spot, was reported on sugar maple and mountain maple, A. spicatum, in Massachusetts. According to W. H. Davis, there was less on mountain maple than in 5 years, comparatively few infected trees were observed.

Verticillium sp. (also reported as V. albo-atrum, V. dahliae), wilt: Least seen in 5 years in Massachusetts, according to W. H. Davis; Maine; Vermont; Connecticut; New Jersey; Pennsylvania, on A. platanoides; Virginia; Illinois (PDR 22: 253-254); the occurrence of verticillium wilt of maple in the Pacific Northwest is reported by J. L. Bedwell and T. W. Childs (PDR 22: 22-23).

Leaf blight (drought): Washington, in Adams and King Counties.
Leaf scorch (physiological): New Hampshire and New Jersey.
Sunscald (physiological): New Jersey.

AESCULUS HIPPOCASTANUM. HORSECHESTNUT:

Guignardia aesculi, leaf blotch, in Massachusetts was less prevalent than for several previous years. It often causes leaf-fall in mid-summer but there was little leaf-fall in 1938 (S. H. Davis); general distribution in Pennsylvania; in Clarke County, Georgia, the disease was reported on A. georgiana.
Leaf burning (drought): Washington, in Spokane County.

AMELANCHIER sp. SHADBLOW:

Fabraea maculata, leaf blight, on A. canadensis in Clarke County, Georgia.

ARBUTUS MENZIESI. MADRONE:

Progressive dying of this species on a rather large scale was observed in several localities in California--cause not yet determined. (J.L. Mielke, Division of Forest Pathology).

BETULA spp. BIRCH:

Cercospora sp., leaf spot: New Hampshire.
Cytospora chrysosperma: New York.
Fomes sp., wood decay: New Jersey.
Poria sp., sterile birch conk in West Virginia: Sterile clinker-like conks recently found by Campbell and Davidson to be a stage in the development of a Poria of the P. obliqua complex were collected on a young sweet birch (Betula lenta) near Glady, West Virginia, in April 1938. The fungus was isolated from the decayed wood and identified by Ross W. Davidson as the same species that causes extensive heart rot of living birch in the Lake and Northeastern States. So far as can be ascertained, this is the only collection of this sterile conk (Poria sp.) made south of Pennsylvania. (Elmer R. Roth, Civilian Conservation Corps, Bureau of Plant Industry).
Leaf scorch (physiological): New Jersey.

CASTANEA spp. CHESTNUT AND CHINQUAPIN:

A list of fungi that have been found on chestnut and chinquapin in the Pacific Northwest is given by J. L. Bedwell and Marvin E. Fowler (PDR 22: 208-210).

Endothia parasitica, blight: New York, New Jersey, and North Carolina. L. E. Miles sent in a specimen of C. dentata from Union, Mississippi, which was identified by M. E. Fowler as blight; the Natural History Survey reported the disease at Vandalia, Fayette County, Illinois, August 17. For history of chestnut blight in Illinois see Reporter 22: 308-314.

CASTANOPSIS spp. CHINQUAPIN:

Fungi found on chinquapin in the Pacific Northwest, listed by Bedwell and Fowler (PDR 22: 208-210).

CATALPA spp. CATALPA:

Armillaria mellea, mushroom root rot, was reported on C. speciosa from Washington, in Lewis County.
Heterodera marioni, root knot, heavily infested C. speciosa in Oklahoma, according to K. S. Chester.
Leaf scorch (physiological): New Jersey.
Die-back (undet.) was reported from Mason and Snonomish Counties, Washington.

CELTIS spp. HACKBERRY:

Cylindrosporium sp., leaf spot: Iowa, less prevalent than for several previous years.
Phymatotrichum omnivorum, root rot, in Brazos and Navarro Countis, Texas.
Septoria gigaspora, leaf spot, on C. pumila georgiana in Clark County, Georgia.

CORNUS spp. DOGWOOD:

Gloeosporium sp., leaf spot: Suffolk County, Long Island, New York.
Phytophthora cactorum, canker, was a very destructive and widely distributed disease of flowering dogwood (C. florida) on Long Island, New York, according to D. S. Welch. The disease appeared most often on older and transplanted trees (PDR 22: 403); the disease was also reported from New Jersey.
Septoria cornicola, leaf spot: Georgia, in Clarke County.
Leaf burning (drought): Washington, in Cowlitz County.

CRATAEGUS. HAWTHORN:

Fabraea maculata, leaf blight, was reported by Stoddard on C. oxyacantha in Connecticut; "extremely destructive through New Jersey, causing complete defoliation by August 1 on many English hawthorns." Leaf blight was generally distributed throughout New Jersey on English hawthorn. Owing to excessive rainfall the past season was ideal for infection and spread of the disease (PDR 22: 350-351).

Gymnosporangium sp., cedar-apple rust: Nebraska.
G. betheli ? rust: Puget Sound Nurseries, Washington.
G. clavipes, quince rust: Connecticut, Virginia, and Washington in Pierce County.
G. globosum, hawthorn rust was less prevalent in Oklahoma than for several previous years; Wisconsin, scattered distribution, but more prevalent than last year.

DIOSPYROS VIRGINIANA. PERSIMMON:

Cephalosporium sp., wilt of persimmon, in the southeast was reported by Bowen S. Crandall (PDR 23: 56-58). A map shows areas known to be infected by the wilt at the close of the 1938 scouting period; these include Tennessee, Mississippi, Alabama, Georgia, Florida, and South Carolina.
Podosphaera oxyacanthae, powdery mildew: Texas, in McLennan County.

FAGUS spp. BEECH:

Nectria cinnabarina, canker, was more prevalent than for several previous years in Massachusetts. Davis reported, "New stations are detected each year. Even following pruning the fungus is observed the next year."

FRAXINUS spp. ASH:

Cercospora sp., leaf spot, on F. texensis in Hidalgo County, Texas.
Fomes fraxinophilus, heart-rot, usual prevalence in North Dakota on F. lanceolata.
Gloeosporium sp., anthracnose, on F. pennsylvanica was more prevalent than last year or for several years in Minnesota, owing to excess moisture in the spring.
Puccinia fraxinata, rust, was more prevalent than usual in Minnesota on F. pennsylvanica owing to excess spring rains, according to C. M. Christensen.
Heterodera marioni, root knot, on F. lanceolata in Oklahoma.

ILEX spp. HOLLY:

Cladosporium, scab-like spot: Two collections in Oregon, one from Grant's Pass and the other from Oregon City (PDR 22: 61).
Fumago ? sooty mold: Texas, in Cherokee County.
Phomopsis sp., canker: Washington, in King County.
Phyllosticta sp., leaf spot: New Jersey; Oklahoma, general, according to Chester, other leaf spots, not referable to Phyllosticta, were also quite common on holly.
P. opaca, leaf spot: Texas, in Cherokee County.
Spumaria (myxomycete), smothering: Oklahoma.
Twig and leaf blight (cause unknown): Washington.
Winter injury: New Jersey.

JUGLANS spp. WALNUT:

Cylindrosporium sp., leaf spot: K. S. Chester reported one collection on J. nigra in Stillwater, Oklahoma.
Marssonia juglandis, leaf spot, was reported by Alma Waterman from New York and Wisconsin.

LIRIODENDRON TULIPIFERA. TULIPTREE:

Phyllosticta liriodendrica, leaf spot, was reported by the Natural History Survey at Villa Ridge, Pulaski County, Illinois, July 28.

MAGNOLIA spp. MAGNOLIA:

Dimerosporium magnoliae, sooty mold, was reported from Hardin County, Texas. This is the first report to the Survey from Texas on this host.
Heterodera marioni, root knot: Texas, in Bell and Cherokee Counties.
Black leaf spot (cause nutritional?): Reported by the Department of Plant Pathology from Island and Kitsap Counties, Washington.

MALUS spp.

Bacillus amylovorus, fireblight, was reported from New Jersey on flowering crab.
Gymnosporangium spp., rust: New York on flowering crab in Dutchess County, and some ornamental apples in Nassau County.
Phyllosticta sp., leaf spot, on native crab, M. ioensis, in Iowa caused a trace loss, according to I. E. Melhus.

MELIA AZEDERACH. CHINABERRY:

Cercospora meliae, leaf spot: Texas.
Phymatotrichum omnivorum, root rot: Texas.

PLATANUS spp. SYCAMORE:

Ceratostomella sp., on London plane, P. acerifolia, has become epidemic and serious in several localities, including Philadelphia and nearby New Jersey and Baltimore, and occurs in Washington, D. C. (PDR 23: 47-48).
Gnomonia veneta, anthracnose and blight: Massachusetts, "Less seen this year. However, it came early for 2 weeks. Trees revived and little seen afterwards"; about the same amount as for several previous years in Connecticut: New Jersey, on P. occidentalis and P. orientalis; Illinois, on P. occidentalis at Greenville, Bond County, May 18; Nebraska, unusually severe this year (PDR 22: 212); "Sycamore blight (G. veneta) was especially prevalent in parts of California on ornamental sycamores and the native P. racemosa, causing almost complete defoliation of the trees in some districts." - J. L. Mielke, Division of Forest Pathology.

Microsphaera alni, powdery mildew, was more prevalent in Pennsylvania than for several previous years, according to R. S. Kirby.
Oidium obductum, powdery mildew: Richmond, Virginia.

POPULUS spp. POPLAR:

Cytospora sp., canker, on *P. nigra bolleana* in New Jersey.
C. chrysosperma, canker, was reported by R. W. Goss as being very common in Nebraska; in North Dakota W. E. Brentzel reported the disease more prevalent than for several previous years, "50 percent in our planting in Cass County"; Kansas.
C. nivea, canker, on *P. tremuloides* in New Mexico.
Dothichiza populea, canker: From Massachusetts W. H. Davis wrote that he had seen more Turkestan poplars die this year than he had ever seen in 10 years. Whole rows seemed to die at once and all were highly infected. The cyclone blew down 2/3 of the trees; Wisconsin, local distribution, less prevalent than last year.
Melampsora sp., rust, was more prevalent than last year in Wisconsin, owing to the wet weather.
M. medusae, rust: Kansas, at Onaga on *P. deltoides*; Washington, in Grays Harbor County.
Septoria populicola, leaf spot: Texas, in Reeves County.
Taphrina aurea, yellow leaf blister: Washington, in Island County.

PRUNUS spp.

Bacterium pruni, leaf spot, was reported on flowering plum, *P. triloba*, in New Jersey.
Coryneum beijerinckii, blight, in Idaho (PDR 22: 151).
Yellow-red virosis (X-disease) on chokecherry, *P. virginiana*, in Vermont, Massachusetts, Connecticut, New York (PDR 22: 394).

QUERCUS spp. OAK:

Armillaria mellea, associated with a root rot of uncertain cause: R. E. Vaughan reported that Dr. A. J. Riker was conducting some research on this question. Oaks were dying more than ever in Wisconsin.
Cylindrosporium microspilum, leaf spot, on *Q. palustris* at Havana, Mason County, Illinois, July 20.
Gloeosporium canadense, anthracnose, was much more prevalent in New Haven County, Connecticut, than for several years.
Gnomonia veneta, anthracnose, was less prevalent in Massachusetts than usual. There were scattered cases of defoliation; New Jersey; Wisconsin, more prevalent than usual owing to the wet weather; reported as leaf scorch in New York--white oak was the most susceptible variety; in Minnesota it was more prevalent than last year or in an average year, owing to excess moisture in spring months, "Lower branches of many trees defoliated in June, new leaves put out in July. No apparent injury."

Microsphaera extensa, powdery mildew, was reported by the Natural History Survey at Metropolis, Massac County, Illinois, October 4.

Phomopsis sp.: Texas, in Dallas County.

Polyporus pargamenus and P. versicolor: Infected oak trees were situated on the top of a small mountain about 1 mile from the center of Dover, New Jersey. Only the trees on the top of the mountain, or on the side, were infected, trees in the valley seemed free.

Rhytisma erythrosporum, tarspot: Texas, in Bell and Brazos Counties on live oak, Q. virginiana.

Stereum frustulosum (Pers.) Fr. until recently has been reported as causing decay only in the wood of dead trees or in dead wood of wounds on living trees in the United States. During the course of examination of top rot and decay following fire in the southern Appalachian territory during 1938, S. frustulosum was found to be more common and to cause more extensive decay than any other fungus isolated. Decay was found to extend as much as 20 feet up the bole of fire-wounded oak trees. It was not uncommon for an entire tree to be culled because of the presence of S. frustulosum as top rot extending down the tree often connected with butt rot extending upward. Isolations from these studies were made and the fungus was identified by Ross W. Davidson. (Elmer R. Roth, Civilian Conservation Corps, Bureau of Plant Industry).

Strumella coryneoidea, canker, has continued to be prevalent in Massachusetts. In North Carolina: "S. coryneoidea, the cause of a widely distributed canker disease of oaks and occasionally other hardwood species, has been known to occur from Virginia north to Vermont and west to Minnesota. In March 1938 one tree infected with Strumella was found on the Pisgah National Forest in the vicinity of Pilot Mountain. Shortly afterwards 4 infected trees were found on the Nantahala National Forest in the vicinity of Aquone, North Carolina. Since that time another infected tree has been found on the Bent Creek Experimental Forest near Asheville, North Carolina. The collection from Pilot Mountain was verified by cultures sent to Ross W. Davidson. While the disease does not appear to be abundant in North Carolina, it is fairly common in the hardwood region of the western part of the State. The infections found were on trees between 20 and 30 years old." - Elmer R. Roth, Civilian Conservation Corps, Bureau of Plant Industry.

Taphrina coerulescens, leaf blister: North Carolina, "This disease occurred in many localities, but it was much less severe than it was in 1936 and 1937"; on Q. borealis in Minnesota it was more prevalent than for several years, owing to excess rain. "Sender stated some trees were heavily infected, good collection sent in. Many of the areas covered with asci were infected with Monochaetia"; Texas, in Austin County; in Georgia a large number of water oaks were observed severely affected (PDR 22: 211); conspicuous and severe in South Carolina, Georgia, and Alabama (PDR 22: 164).

RHAMNUS CATHARTICA. BUCKTHORN:

Puccinia coronata, crown rust: Scattered distribution in North Dakota, but more prevalent than for several previous years. "Severe infection in some plantings near Fargo."

RHUS spp. SUMAC:

Verticillium sp., wilt: Nebraska, according to R. W. Goss, "First report for the State."
V. albo-atrum, wilt, was reported on smoketree, R. cotinus, in New York by O. A. Reinking; the disease was reported from Princeton, Bureau County, Illinois, in 1937. The first report in the United States on this host to the Survey was made by Marvin E. Fowler (PDR 21: 10).

ROBINIA PSEUDOACACIA. LOCUST:

Fusicladium robiniae, leaf spot and petiole lesions, was widely distributed, it occurred in nurseries in the following 9 States: Alabama, Arkansas, Georgia, Maryland, Missouri, North Carolina, South Carolina, Tennessee, and Virginia (PDR 23: 63-65).
Macrosporium sp., leaf disease, was more restricted in its distribution than Fusicladium robiniae. It occurred in nurseries in Alabama, Georgia, Missouri, North Carolina, and Tennessee (PDR 23: 63-65).
Heterodera marioni, root knot, was very severe in nursery trees in Oklahoma, according to K. Starr Chester. See also Phytopath. 29: 4-5, 1939.
Witches'-broom (virus): Examination of specimens in phanerogamic herbaria showed that the disease occurred in Pennsylvania, Delaware, District of Columbia, Tennessee (1936), and Georgia many years ago. The specimen from Pennsylvania showed that the disease had been in this country for at least 69 years (PDR 22: 148, 255-256). During 1938 the disease was observed in Maryland, District of Columbia, Pennsylvania, Ohio, Virginia, Tennessee, North Carolina, and Arkansas. Lurton, Arkansas is the farthest west it is known at the present time (PDR 23: 41-43).

SALIX spp. WILLOW:

Cytospora chrysosperma, canker: Oklahoma, in Wagoner County; Wisconsin, scattered distribution, prevalence same as last year; Nebraska.
Fusicladium saliciperdum, scab, was reported much less prevalent during 1938 than during 1937. Massachusetts reported it less prevalent than for several previous years, "Caused very little if any leaf fall"; "strikingly evident in 1938" in Maine (Steinmetz and Prince, PDR 22: 282-283); "Willow blight was much less severe in Vermont in 1938 than in 1937."

Marssonina sp., leaf spot: Washington, in Cowlitz County.
M. populi, leaf spot: Oklahoma, "One record from Stillwater."
Melampsora bigelowii, rust: Kansas.
Valsa leucostoma, twig canker: Massachusetts, "Fewer cankers on trees for last 2 years."

SAMBUCUS spp.

Blight and leaf burn caused by drought injury was reported from Whitman County, Washington, by the Department of Plant Pathology.

SORBUS spp. MOUNTAIN ASH:

Bacillus amylovorus, fireblight: New Jersey.
Cytospora chrysosperma, canker: New Jersey.
Fomes fraxinophilus, heart rot: Nebraska.
Septogloeum sp., leaf spot: Nebraska.

ULMUS spp. ELM:

Cephalosporium sp., wilt: Nebraska.
Ceratostomella ulmi, Dutch elm disease distribution in the United States, 1930-1938, is shown on 2 maps (PDR 23: 92) furnished by the Bureau of Entomology and Plant Quarantine. The first map shows the areas where infected elm trees have been found since the first discovery of the disease in this country, and the second one shows the yearly extent of the disease in the infection area around New York Harbor. For Dutch elm disease control, with map showing distribution of the disease in New York State in 1938, and the number of diseased elms found and eradicated listed by county and year, 1933 to 1938, see Ann. Rept. Dept. Agr. and Mark. N.Y. 1938: 176-183. 1939). (For further information on eradication and distribution see PDR 22: 212, 462; 23: 182-183). During the year the disease was found for the first time in Pennsylvania in Northampton and Bucks Counties adjoining the infected area in New Jersey (PDR 22: 306, 350); and in Dutchess and Ulster Counties in New York, also extensions of the main infected area (PDR 22: 306, 409). Recurrence was reported in the outlying areas at Wiley Ford, West Virginia; Athens, Ohio; and Indianapolis, Indiana.
Cytospora sp., canker: North Dakota, "Only one report."
Gloeosporium inconspicuum, leaf spot, was reported by I. E. Melhus from Iowa as less prevalent than in an average year.
G. ulmi, anthracnose, in Minnesota was much more prevalent on U. pumila than for several previous years owing to abnormally high humidity and precipitation. The disease was more prevalent than last year or for several previous years on U. americana, "Apparently causes little damage even on heavily infected trees—leaves drop somewhat earlier than those from healthy trees."

Gnomonia ulmea, black spot, was notably conspicuous and damaging in Massachusetts this year; it was more prevalent than usual in Connecticut; New York, general distribution; New Jersey; Texas; in Oklahoma the disease "appeared unusually early and caused defoliation in early summer in some locations," more prevalent than in 1937; also more prevalent in Wisconsin; Illinois, on U. americana at Schram City, Montgomery County, October 13, on U. pumila, Norris City, White County, June 7, Alton, Madison County, August 1, and Pekin, Tazewell County, August 3; Nebraska, on U. parvifolia.

Phyllosticta melaleuca, leaf spot, on U. americana at Anna, Union County, Illinois, June 7.

Phymatotrichum omnivorum, root rot, on Ulmus spp. and U. parvifolia in Texas.

Sphaeropsis sp., canker, was less prevalent than last year in Wisconsin.

Verticillium albo-atrum, wilt: Few reports were received and none indicated injury. Occurrence of Verticillium sp. on elm in the Pacific Northwest was reported by J. L. Bedwell and T. W. Childs (PDR 22: 23).

Heterodera marioni, root knot, on U. americana and U. parvifolia, "Nursery stock heavily infested at Stigler," Haskell County, Oklahoma.

Phloem necrosis (virus): In 1938, elm phloem necrosis was found to be rather generally distributed over an area bounded by Columbus, Ohio, to Danville, Illinois, on the north; Danville, Illinois, to Hillsboro, Illinois, to Greensburg, Kentucky, on the west; Greensburg, Kentucky, to Williamson, West Virginia, to Parkersburg, West Virginia, on the south; and Parkersburg, West Virginia, to Columbus, Ohio, on the east. Due to the prevalence of the disease in this area, it is probable that the disease occurs over a much larger area than indicated here, especially westward and south along the Mississippi River Valley. Field observations indicate the possibility that elm phloem necrosis has been present in southern Indiana and Illinois and in northern Kentucky for a number of years and that natural selection for resistance has been taking place. (Roger U. Swingle, Division of Forest Pathology). See also Plant Disease Reporter 23: 45.

DISEASES OF ORNAMENTAL AND MISCELLANEOUS PLANTS

The following list of articles on ornamental diseases which appeared in the Plant Disease Reporter supplements this summary:

Carter, J. C. Frost injury to woody plants in Illinois in May, 1938. Reporter 22: 434-435. 1938.

Dimock, A. W. Some unusual diseases of ornamentals reported in New York during 1938. Reporter 23: 15. 1939.

Middleton, John T. Sclerotinia sclerotiorum on ornamentals in Missouri. Reporter 22: 300-301. 1938.

Pirone, P. P. The detrimental effect of walnut to rhododendrons and other ornamentals. Reporter 22: 450-452. 1938.

Stevenson, John A. Rusts recorded from new localities. Reporter 22: 357. 1938.

ALLIUM CANADENSE. MEADOW GARLIC:

Uromyces bicolor, rust: New York.

ALTHAEA ROSEA. HOLLYHOCK:

Cercospora althaeina, leaf spot: According to Ray Nelson, in Michigan this leaf spot was the most common one on hollyhocks. The disease was apparently seed-borne; I. E. Melhus reported it more prevalent in Iowa than for several previous years.

Puccinia heterospora, rust: Texas.

P. malvacearum, rust: O. A. Reinking reported the usual prevalence from New York; New Jersey, in Bergen and Middlesex Counties; Ray Nelson, reporting from Michigan, remarked, "Hollyhocks and Malva rotundifolia rusted generally"; rust, in Wisconsin, was more prevalent than last year owing to the wet weather; Washington, in Pend Oreille, Clark, and Cowlitz Counties.

Septoria fairmani, leaf spot, was reported by L. Dosdall as more prevalent than for several previous years in Minnesota.

ALYSSUM MARITIMUM. SWEET ALYSSUM:

Peronospora parasitica, downy mildew, was reported from Guadalupe, California, on June 4, by M. W. Gardner. This is the first report on Alyssum to the Survey.

ANTIRRHINUM MAJUS. SNAPDRAGON:

Botrytis sp., blight: New York, in greenhouses on Long Island; in Pennsylvania, R. S. Kirby reported, "Severe as stem canker in greenhouses around Philadelphia"; Oklahoma, "A single record from Oklahoma City."

Colletotrichum antirrhini, anthracnose: New Jersey; in greenhouses and field plantings in Pennsylvania, more prevalent than for several previous years.

Oidium sp., powdery mildew, in Pennsylvania, was reported by R. S. Kirby as "Most severe in greenhouse plantings."

Peronospora antirrhini, downy mildew, was reported from a small retail nursery in the Santa Clara Valley, California, by M. R. Harris, apparently the first instance of its presence in the United States. It was thought the infection came in on seed from Europe, but absolute proof of this could not be obtained (PDR 23: 16).

Phyllosticta antirrhini, blight, was reported by L. Dosdall from Minnesota as observed only in one greenhouse in Hennepin County, where it was doing considerable damage just as plants were beginning to flower.

Phytophthora cactorum, wilt: New Jersey.

Puccinia antirrhini, rust, was reported over a wide range as usual. In Kansas it was said to be present in numerous locations where it had been absent for several years.

Pythium irregulare was responsible for a stem rot of field and greenhouse snapdragons in the San Francisco Bay region of California (PDR 22: 355); first report on this host to the Survey from the State. P. ultimum also caused root and stem rot of snapdragon in the San Francisco Bay region of California (PDR 22: 356). Sclerotinia sclerotiorum, stem rot, was common in poorly managed greenhouses in Michigan from December to March.

Verticillium sp., wilt, was "Rather severe in greenhouses around Philadelphia," Pennsylvania, according to R. S. Kirby; New Jersey. V. albo-atrum, wilt: New York, in Wayne County. Heterodera marioni, root knot: Texas; in Oklahoma, Chester reported a single record from Sand Springs. Mosaic (cucumber virus 1) was noted in Kansas.

AQUILEGIA spp. COLUMBINE:

Phytophthora sp., blight, was observed only in one garden in Ramsey County, Minnesota, where the plants were severely injured, according to L. Dosdall. Sclerotium delphinii, crown rot: New Jersey. S.

rolfsii, southern blight, was reported "Destructive in a garden in Tulsa, Oklahoma. No previous record on this host was found."

AZALEA spp. AZALEA:

Exobasidium burtii: In New Jersey a heavy infection was observed on seedlings of the following Azalea varieties in a nursery: rosea, nudiflora, viscosa, canescens, and japonica, "all being new hosts for this species except the last." E. vaccinii, leaf curl, was reported from Connecticut, New York, Pennsylvania, and Washington. This is the first report to the Survey from Washington. Septoria azaleae, leaf scorch, was reported always very destructive in greenhouses in New Jersey during the winter months. Sporocybe azaleae, bud blight: Massachusetts.

BEGONIA spp. BEGONIA:

Pythium sp., stem rot: One report on B. tuberhybrida from New York; New Jersey. P. intermedium was common on B. tuberhybrida in several large commercial greenhouses in San Francisco, California, according to John T. Middleton (PDR 22: 355). P. ultimum caused stem rot of B. lloydii and B. semperflorens in the San Francisco Bay region of California (PDR 22: 355). Bacterium sp., leaf spot: New Jersey, in Passaic County. B. begoniae was reported on tuberous begonias in New York by W. H. Burkholder. Nematodes, in New Jersey, were severe in many greenhouses on B. melior. Aphelenchoides fragariae, leaf nematode: New York.

BERBERIS spp. BARBERRY:

Pythium debaryanum caused root rot of B. gracilis at Niles, California (PDR 22: 355). Bacterium berberidis, leaf spot, was severe on all Japanese barberry (B. thunbergii) hedges examined in Illinois, northern Indiana, and Michigan (PDR 22: 366).

BUXUS sp. BOX:

Macrophoma candollei, canker, was present in many hedges in New Jersey, in some instances following winter injury. M. rousseliana, canker: New York; New Jersey.

CALENDULA OFFICINALIS. CALLENDULA:

Sclerotinia sclerotiorum, crown rot: Missouri (PDR 22: 300).

CALLISTEPHUS CHINENSIS. CHINA-ASTER:

Coleosporium solidaginis, rust: New York; Michigan, "A minor disease in open plantings, causes some damage in cloth house plantings"; Wisconsin. Fusarium sp., wilt: Washington. F. conglutinans callis-

tephi, wilt, in New York, was apparently severe even on plants from wilt-resistant seed, according to A. W. Dimock; Wisconsin, less prevalent than for several previous years. Phomopsis callistephi, stem canker: Wisconsin. Pythium ultimum caused root and stem rot of china aster in the San Francisco Bay region of California. Yellows (virus): In Massachusetts, W. H. Davis reported the disease more prevalent than for several years; New York; in Michigan, Ray Nelson reported yellows "General and destructive in open plantings. Commercial growers now using cloth houses more generally." Ditylenchus dipsaci, stem nematode: Washington, in Lewis County.

CAMPANULA PERSICIFOLIA. PEACHLEAF BELLFLOWER:

Coleosporium campanulae, rust: Berkeley, Alameda County, California.

CATTLEYA DOWIANA AUREA. ORCHID:

Uredo behnickiana, rust: New York, on Staten Island, "Rarely reported, previously noted by New Jersey Station" (PDR 23: 16).

CENTAUREA spp. CENTAUREA:

Sclerotinia sclerotiorum, blight: Missouri (PDR 22: 300). Sclerotium delphinii, crown rot, in New Jersey, was favored by excessive moisture and high temperature. Bremia lactucae, downy mildew, was reported on C. cyanus by M. W. Gardner from Lompoc, Santa Barbara, California. This was the first report to the Survey on this genus (PDR 22: 356).

CHENOPODIUM ALBUM. LAMB'S-QUARTERS:

Heterodera marioni, root knot: According to Chester, in Oklahoma, "This weed is one of our best indicators of root knot in fields. It is generally infested along river bottoms."

CHRYSANTHEMUM spp. CHRYSANTHEMUM:

Erysiphe cichoracearum, powdery mildew: Minnesota, in greenhouses.

Puccinia chrysanthemi, rust, was reported from Louisiana in a garden in Baton Rouge by A. G. Plakidas, according to their files this is the first time chrysanthemum rust has been found in Louisiana; Washington, in Spokane County. Sclerotinia sclerotiorum, blossom rot: A. G. Plakidas reported this rot at base of petal. "The organism was isolated from every flower sent in. First time this type of rot has been found on chrysanthemum in Louisiana."

Septoria sp., leaf spot: New York; New Jersey. S. chrysanthemella (S. chrysanthemi), leaf spot, was reported from Suffolk County, New York, on C. hortorum by A. W. Dimock. "Also reported from Rutherford and Madison, New Jersey." S. obesa, leaf spot: The New Jersey Agricultural Experiment Station reported injury most pronounced on Mrs. H. Harrison, Scarlet Wonder, Mrs. Sam Rotan, Psyche, Rapture, R. Marian Hatton, Oconte, Thelia, Sequoia Irene, Orange Wonder, and Caroline Babcock.

Verticillium sp., wilt, in New Jersey, was extremely severe throughout most of greenhouse forcing varieties; reported from Washington, in Skagit County. V. albo-atrum was common in greenhouses around the Twin Cities in Minnesota. The variety Crimson Glow was practically a total loss. V. dahliae: New York, on glasshouse plants.

Aphelenchoides fragariae, leaf nematode, was much more prevalent than for several years in New York. A. W. Dimock wrote, "Unusually heavy rains in the Hudson Valley and New York area made the disease extraordinarily destructive in outside plantings." Cuscuta sp., dodder: New York, "3 scattered reports"; Morris County, New Jersey.

Yellows (Aster yellows virus): In Michigan, according to Ray Nelson, yellows was observed in forcing varieties grown in cloth houses and occasionally in greenhouses.

CONVALLARIA MAJALIS. LILY-OF-THE-VALLEY:

Gloeosporium sp. (?) convallariae, leaf spot: Westchester County, New York, a Gloeosporium definitely present, specific determination not made (A. W. Dimock).

CORNUS FLORIDA. FLOWERING DOGWOOD:

Phytophthora cactorum, crown rot: Long Island, New York (Welch, PDR 22: 403).

CORYDALIS sp. SCRAMBLED EGGS:

Peronospora corydalis, downy mildew: Oklahoma, in Payne County.

DAHLIA spp. DAHLIA:

Erysiphe sp., powdery mildew: Pennsylvania. Rhizoctonia sp., stem rot: New Jersey, associated with fertilizer-burning and excessively hot weather. Heterodera marioni, root knot: Texas. Ring spot (virus): In Michigan, Ray Nelson reported that this is a common disease in nearly all commercial plantings; Wisconsin. Stunt (virus): Michigan, the more general practice of rogueing is reducing this disease in commercial fields (Ray Nelson). Mosaic (virus) in North Carolina caused heavy damage to certain varieties, according to R. F. Poole.

DAPHNE sp. DAPHNE:

Phytophthora sp., collar rot: Brewster Point, New York, apparently not previously reported, according to A. W. Dimock. First report in the Survey files. Sclerotium delphinii, crown rot, on D. odora: Oregon (PDR 23: 48).

DELPHINIUM spp. LARKSPUR:

Botrytis sp., blight: Wisconsin, reported more prevalent than for several previous years owing to the wet weather. Diaporthe arctii (Phomopsis stage), stem canker, was reported from Ithaca, Tompkins County, New York, on perennial delphinium and on D. ajacis, by A. W. Dimock, who remarked that the disease is seldom reported and is apparently seed-borne. It had not been reported previously on perennial delphinium.

Erysiphe cichoracearum, powdery mildew: Minnesota, in Hennepin and Ramsey Counties. Pythium complectens, root and stem rot, on Delphinium ajacis, caused appreciable loss at Salinas, California (PDR 22: 355). Rhizoctonia sp., crown rot: New York, on hybrid delphiniums, causing rotting in original flats before transplanting to greenhouse, also rotting in pots (O. A. Reinking). Sclerotinia sclerotiorum, crown rot of D. ajacis, greenhouses in Missouri (PDR 22: 300).

Sclerotium delphinii, crown rot, in New York, was reported by A. W. Dimock as more prevalent than usual. The unusually heavy rains of July, August, and September were especially favorable for crown rot. Also reported from New Jersey. Septoria delphinella, blight: Reported by the Illinois Natural History Survey at Kampsville, Calhoun County, June 23, the first report to the Survey.

Bacterium delphinii, bacterial leaf spot or black spot, was reported as notably conspicuous and damaging in Massachusetts (PDR 22: 297), New York, Michigan (where it was said to be general in season of frequent rains such as in 1938), Minnesota, and Wisconsin. Erwinia phytophthora, crown rot: New York; Minnesota, in Hennepin County, where it was observed only in one locality on plants growing in a cloth house (L. Dosdall).

DIANTHUS CARYOPHYLLUS. CARNATION:

Alternaria dianthi, leaf spot and blight: New York; New Jersey; and Texas. Fusarium spp., Fusarium wilt and branch rot: Chester reported branch rot common and fairly destructive in greenhouses in Pontotoc and Oklahoma Counties, Oklahoma; wilt was observed in Spokane County, Washington. Heterosporium echinulatum, leaf spot, was found for the first time in Oregon. It caused considerable damage in greenhouses (PDR 22: 70-71).

Rhizoctonia sp. ?, damping-off: Schenectady, New York. R. solani, stem rot: Kansas, in greenhouse. Uromyces caryophyllinus, rust: Texas; Nebraska; and Washington. Bacterium dianthi, leaf spot, was occasionally seen causing damage in some varieties in Michigan, according to Ray Nelson. Streak (virus) was reported from Washington and Idaho. Chlorosis (potash deficiency): New Jersey.

DIEFFENBACHIA PICTA. TUFTROOT:

Bacterium sp., leaf blotch: New Jersey, "A leaf blotch of Dieffenbachia picta, heretofore attributed to a species of Gloeosporium, has been found to be caused by a bacterium. The causal organism, whose identity is still unknown, has been consistently isolated from the young leaf blotches before the Gloeosporium entered the necrotic areas. Inoculations with this bacterium have produced infection and it has been repeatedly re-isolated." (New Jersey Agricultural Experiment Station).

FORSYTHIA SUSPENSA. WEEPING FORSYTHIA:

Phomopsis sp., stem galls: Kentucky (PDR 22: 349-350).

GARDENIA FLORIDA. GARDENIA:

Erysiphe polygoni, powdery mildew, was reported from Texas. Fumago vagans, sooty mold, was also reported from Texas. Phomopsis gardeniae, canker: New Jersey, more severe than usual in greenhouses. Heterodera marioni, root knot: In Oklahoma Chester reported, "A single report from Oklahoma City."

Cork formation caused by method of storage: O. A. Reinking reported from Rochester, New York, "In greenhouse--perhaps manure heated somewhat."

Bacterial disease: The New Jersey Agricultural Experiment Station reported as follows: "Some preliminary work seems to indicate that a heretofore undescribed bacterial disease of gardenia has appeared for the first time this year. During the past season, spots which are rather typical of those produced by pathogenic bacteria have been appearing in large numbers on the gardenias grown in sand culture by the Horticultural Department of this Station. The presence of several spots on a leaf causes the leaf to turn yellow and drop. Some circumstantial evidence indicates that the disease was brought into the houses on some gardenia varieties imported from the South last spring."

GERANIUM SANGUINEUM. BLOODED CRANESBILL:

Phytomonas geranii, leaf spot, was reported by W. H. Burkholder near Ithaca, New York.

GEUM CHILOENSE. CHILOE AVENS:

Peronospora potentillae, downy mildew, was reported on Lady Bradshaw variety by M. W. Gardner, from Salinas, California.

GLADIOLUS spp. GLADIOLUS:

Fusarium spp., fusarium rot, wilt and yellows: New York and New Jersey; in Itasca County, Minnesota, wilt was observed only in corms brought in by Nursery Inspector. The grower reported that 50 percent of his plants wilted in 1937 (L. Dosdall); in Michigan, according to Ray Nelson, fusarium yellows was observed in varying amounts in nearly all commercial plantings, and was increasing year by year. F. oxysporum gladioli was reported from New York by O. A. Reinking.

Penicillium sp., storage rot: New Jersey, in Monmouth County. Sclerotinia gladioli, dry rot: In reporting from Michigan, Ray Nelson remarked, "A minor disease from 1931 to 1937. Since then increasing because of more favorable soil conditions--more nearly normal rainfall"; Washington, in Pierce County. Septoria gladioli, hard rot, was observed for the first time in field plantings at Honor, Michigan. Planting stock came from New York (Ray Nelson): Wisconsin, usual prevalence. Urocystis gladioli, corm smut, was reported by H. W. Rankin from Erie County, Pennsylvania. This is believed to be the first report of the gladiolus smut from America (See also Phytopath. 28: 598-600. 1938).

Bacterium gummisudans, leaf spot: A. W. Dimock reported very bad infection on first season plants in New York; according to R. E. Vaughan, there was the usual prevalence in Wisconsin; Minnesota, in Stearns County. First year observed since 1934 (L. Dosdall). B. marginatum, scab, was collected 4 or 5 times in New York, according to W. H. Burkholder; in New Jersey the disease was reported unusually severe on many plants. The varieties Gloriana and Betty Nutshell were especially susceptible; Pennsylvania, at Harrisburg; Chester reported a single lot intercepted by one seed inspector at Oklahoma City, Oklahoma; the bacterial blight was very severe on some varieties of gladiolus at Ovid, Michigan (PDR 22: 367). Ray Nelson reported scab present in all commercial fields. Serious only where rotations and treatment was not practiced; Wisconsin; Nebraska; Washington, in Pierce County.

Mosaic (virus) was more prevalent in Wisconsin than in 1937; Nebraska. Surface breakdown (cause unknown): Michigan, sunken, diseased areas on corms of some varieties--much more general than usual. Physiological in origin, possibly unfavorable storage conditions (Ray Nelson).

GODETIA AMOENA. FAREWELL-TO-SPRING:

Peronospora arthuri, downy mildew, at Lompoc, California. This is the first report to the Survey on any Godetia sp. (PDR 22: 356).

GYPSOPHILA sp. GYPSOPHILA:

Graft blight: The New Jersey Agricultural Experiment Station reported a severe case of graft blight resulting in losses of thousands of dollars to the grower, apparently produced by one of several fungi carried over in the root stocks.

HEDERA spp. IVY:

Bacterium hederae, bacterial leaf spot: New Jersey; in Michigan Ray Nelson reported the disease observed commonly on the variety Hahn's Self Branching in many greenhouses in April and May.

HYACINTHUS sp. HYACINTH:

Bacillus sp., soft rot: New Jersey in Monmouth County; H. G. MacMillan and O. A. Plunkett reported occurrence of soft rot (probably B. carotovorus) of hyacinth in California (PDR 22: 31-34).

IBERIS AMARA. CANDYTUFT var. GREAT HYACINTH:

Albugo candida, white rust, and Peronospora parasitica, downy mildew, were reported by M. W. Gardner from Guadalupe, California (PDR 22: 356). First reports to Survey of these fungi on Iberis.

ILEX sp. HOLLY:

Boydia insculpta, canker: Washington, first time reported in America (Milbrath, PDR 23: 48).

IPOMOEA spp. MORNING GLORY:

Albugo ipomoeae-panduranae, white rust: In Oklahoma, on I. purpurea, Chester reported, "Vines heavily affected and intertwined among sweetpotato vines which were not in the least infected--quite suggestive of specialization here. One collection." Cercospora ipomoeae, leaf spot, was reported on I. quinquefolia in Puerto Rico. Coleosporium ipomoeae, rust, was rather destructive on I. hederacea at Stillwater, according to W. W. Ray.

IRIS sp. IRIS:

Botrytis convoluta, winter crown rot: Minnesota, fungus active in University Farm area March 14 to May 26 due to prolonged cold and wet weather (L. Dosdall).

Didymellina iridis (Heterosporium gracile), leaf spot: In Massachusetts, O. C. Boyd estimated 2 percent loss, owing to the wet weather throughout the summer; New York, in Yates County; Pennsylvania,

less prevalent than in 1937; in North Carolina, R. F. Poole reported, "This fungus has caused serious damage to plants partially grown under weather-protected conditions. Chemical sprays and dusts have not given any control of the fungus in preliminary trials." An unusually severe outbreak was observed on one farm in the vicinity of Wilmington on February 21 and again on March 11 (PDR 22: 103); Texas, in Cherokee County; Illinois, Champaign, Champaign County, August 8; in Michigan, Ray Nelson reported, "In all old plantings, serious in some, especially where sanitation measures were neglected"; Wisconsin, more prevalent than in 1937, according to R. E. Vaughan; Minnesota, L. Dosdall reported the disease more prevalent than for several years owing to the cool and wet weather; Nebraska; Kansas, D. B. Creager reported this leaf spot abundant in Manhattan on I. germanica; Washington, in King and Pierce Counties.

Fusarium sp., root rot: Washington, in Pierce County. Sclerotium delphinii, crown rot: New Jersey; Illinois. Bacillus carotovorus, soft rot: Massachusetts; New Jersey; Pennsylvania; Wisconsin, more prevalent than in 1937, "Associated mainly with borers"; Nebraska. B. phytophthorus was reported by L. Dosdall from Minnesota, in Anoka, Hennepin, and Ramsey Counties. Bacterium tardicrescens, bacterial blight: Massachusetts and New Jersey. Mosaic (virus): Washington, in Pierce and Island Counties. Blasting (physiological): Washington, in Island County.

KALANCHOE sp. KALANCHOE:

Phytophthora (cactorum?), crown and stem rot: New York, apparently not previously reported. Severe in two greenhouses. Spread favored by excessive rains while plants were outside. Pathogenicity tests being made (A. W. Dimock).

KALMIA sp. MOUNTAIN LAUREL:

Cercospora kalmiae, leaf spot, was reported in New York by O. A. Reinking, from Jericho, Nassau County, Long Island, on K. latifolia. Phyllosticta kalmicola, leaf spot, was present and severe in many plantings in New Jersey. Leaf blight (physiological): Washington, in Island County.

LAGERSTROEMIA INDICA. CREPEMYRTLE:

Cuscuta sp., Dodder: In Oklahoma a single report from Buffalo, Harper County, according to Chester.

LIGUSTRUM spp. PRIVET:

Cercospora sp., leaf spot: Texas, in DeWitt and Hidalgo Counties. Fumago sp., sooty mold: Texas, in DeWitt County. Glomerella cingulata (probably), canker and blight: Kansas. Phymatotrichum omnivorum, root rot: Texas, in Navarro County on Ligustrum sp., on L. amurense in Denton

and Bell Counties, on L. japonicum in Bell County, and L. ovalifolium in Bexar County. Heterodera marioni, root knot: L. amurense was heavily attacked in a nursery at Stigler, Haskell County, Oklahoma; Texas, on same host in Travis County. Chlorosis (physiological): Texas, in Bell County. Freezing injury caused by sudden drop in temperature in November was reported by Stoddard in Middlesex County, Connecticut.

LILIUM spp. LILY:

Bacillus sp., bacterial rot: New Jersey. Botrytis sp., blight: New Jersey, in Essex and Union Counties; reported more prevalent in Wisconsin than for several previous years owing to the wet weather. B. elliptica, blight: New York, on L. candidum; in Michigan it was reported by Ray Nelson as more serious than usual on Madonna and other very susceptible kinds. Penicillium sp., scale rot: Texas, in Hidalgo County.

Phytophthora sp., blight, was more prevalent in eastern Minnesota than last year and much more prevalent than in an average year owing to the cool and wet weather. The most susceptible varieties were L. regale, L. tenuifolium, and L. candidum (L. Dosdall). P. cactorum, root or crown rot, was reported from Auburn, New York, by O. A. Reinking.

Mosaic (virus): New Jersey; Texas, on L. longiflorum in Hidalgo County; Michigan, "Seen in many greenhouses on L. speciosum rubrum, but not serious"; Wisconsin.

LUNARIA sp. MOONWORT:

Plasmodiophora brassicae, club root: New Jersey, in Bergen County.

LUPINUS sp. LUPINE:

Pythium de baryanum caused a stem rot of greenhouse-grown lupine in California (PDR 22: 355).

LYCIUM HALIMIFOLIUM. MATRIMONY-VINE:

Puccinia tumidipes, rust: In Kansas C. O. Johnston reported this rust very abundant through the extremely dry fall (October and November). Early frosts did not seem to affect it.

MAHONIA AQUIFOLIUM. OREGON HOLLYGRAPE:

Cumminsiella sanguinea, rust: Oregon. The pycnial and aecial types characteristic of this genus seldom occur in the Northwest (PDR 22: 51); Washington, in Snohomish County.

MATTHIOLA INCANA. STOCK:

P. complectens, damping-off: California (PDR 22: 355). Rhizoctonia sp., stem rot: New Jersey, in Cumberland County. Sclerotinia sclerotiorum, stem rot, was common in greenhouse plantings from December to March in Michigan.

NARCISSUS sp. NARCISSUS:

Botrytis narcissicola, smoulder, and Stagonospora curtisii, leaf spot, were reported from Washington in Pierce County. Mosaic (virus): Reported from Mercer County, New Jersey, and Lewis County, Washington. For report by Frank P. McWhorter on "Narcissus mosaic and early maturity" in the Northwest, see Reporter 22: 147-148.

OPUNTIA. PRICKLYPEAR:

Hendersonia opuntiae, scald: Texas, in Hidalgo County. Phoma sp., rot: "One report from Pawhuska," Oklahoma, Osage County.

PAEONIA. PEONY:

Botrytis cinerea, gray mold: New Jersey, in Burlington, Monmouth, and Union Counties. B. paeoniae, blight, was notably conspicuous and damaging in Massachusetts this year; New York; Oklahoma; more prevalent in Wisconsin; less prevalent in Minnesota than last year; Nebraska; Washington, in Island County.

Cercospora variicolor, leaf spot, was reported from Iowa by I. E. Melhus. Cladosporium paeoniae, leaf spot: Wisconsin. Phytophthora cactorum, blight, in Minnesota was reported by L. Dosdall as being much more prevalent than for several years. Septoria paeoniae, blight: Minnesota, "Only one report but that a very severe infection. Stems completely girdled and killed." Sclerotinia sclerotiorum, stem rot: Oklahoma, intercepted by State Nursery Inspector. Heterodera marioni, root knot nematode: New York; Wisconsin; Oklahoma, intercepted by State Nursery Inspector. "Crown elongation disease": Oklahoma, intercepted by State Nursery Inspector.

PELARGONIUM spp. GERANIUM:

Alternaria sp., leaf spot: New Jersey. Bacterium erodii, bacterial leaf spot, was reported by F. P. McWhorter on greenhouse-grown geraniums from Eugene, Oregon, with the comment, "This is the first time in several years that we have seen specimens of this leaf spot in this State." B. pelargonii, leaf spot: W. H. Burkholder reported 4 or 5 collections from greenhouses in New York. According to A. W. Dimock, the disease was made unusually severe on P. hortorum by excessive rains.

Thielaviopsis basicola: Connecticut, reported by Florence A. McCormick. Apparently the first record of this fungus growing on geranium (PDR 23: 88).

Crinkle disease (virus) of Pelargonium zonale was observed recently for the first time in New Jersey, according to P. P. Pirone (PDR 22: 146). Ring spot (virus?): Minnesota, L. Dosdall reported, "Only one observation." Oedema (non-parasitic): In several greenhouses on the one variety, Gene Viaud, in Minnesota.

PETUNIA sp. PETUNIA:

Oidium sp., powdery mildew: Minnesota, according to L. Dosdall, "Only one report from plants being grown as houseplants." Rhizoctonia sp., stem rot: New York. Cuscuta sp., dodder, was a garden pest in Buffalo, Oklahoma, according to Chester. Curly top (virus): B. F. Dana reported petunias seriously injured in the Redmond Section of Oregon (PDR 23: 108). Mosaic (cucumber virus) was common in gardens and severe in greenhouses in Oklahoma (PDR 22: 81). Mosaic (virus) was common in Kansas, according to Otto H. Elmer.

PHILADELPHUS sp. MOCKORANGE:

Septoria philadelphi, leaf spot: A trace was reported in Iowa by I. E. Melhus.

PHLOX spp. PHLOX:

Erysiphe cichoracearum, powdery mildew: New York, usual prevalence reported on P. paniculata; New Jersey, Burlington County; Minnesota, in eastern part of State; Washington, in Pierce County. Sclerotium delphinii, crown rot: New York. Septoria divaricata, leaf spot: New York, in Tompkins County. Blight (non-parasitic): Washington, in Thurston County.

PHOTINIA SERRULATA. LOW PHOTINIA:

Oidium leucoconium, powdery mildew: A severe outbreak was reported in western Oregon by J. A. Milbrath (PDR 22: 210-211).

PHYSALIS FRANCHETI. LANTERN GROUNDCHERRY:

Verticillium albo-atrum, wilt: New York City on one planting. Apparently not previously recorded on this plant, according to A. W. Dimock.

PHYSOSTEGIA sp. FALSE-DRAGONHEAD:

Sclerotium rolfsii, southern wilt: Destructive to garden ornamentals in Tulsa, Oklahoma.

PLUMBAGO sp. PLUMBAGO:

Heterodera marioni, root knot: Texas, in Dallas County.

POINSETTIA PULCHERRIMA. POINSETTIA:

Pythium ultimum causes a stem rot of poinsettia cuttings in the San Francisco Bay region (PDR 22: 355).

PRIMULA sp. PRIMROSE:

Pythium irregulare, crown rot of P. obconica was an important disease in commercial greenhouses in San Francisco, California (PDR 22: 355). Root trouble (undetermined): Washington, in Pierce County.

PRUNUS YEDOENSIS. WEEPING CHERRY:

Bacterium tumefaciens, crown gall: New Jersey, in Cumberland County. First report from State on this host.

PYRACANTHA sp. FIRETHORN:

Fusicladium pyracanthae, scab: Ohio State University Campus, Columbus, Ohio (PDR 22: 51). Venturia pyracanthae was reported from Washington, in King County. Phymatotrichum omnivorum, root rot: Texas, in Bell County.

RHODODENDRON sp. RHODODENDRON:

Exobasidium vaccinii, hypertrophy, was reported by R. S. Kirby from Indiana, Indiana County, Pennsylvania. E. vaccinii-uliginosi, witches'-broom, was reported from Essex County, New Jersey, by the State Department of Plant Pathology. Fumago vagans, sooty mold: New Jersey, in Bergen County. Pestalotia sp., leaf spot: New Jersey, in Passaic County. Phytophthora cactorum, tip blight: New Jersey, in Bergen County. Phytophthora cinnamomi, wilt: New Jersey, in Camden County.

Leaf blight caused by drought injury and dieback caused by winter injury were reported from Washington.

ROSA sp. ROSE:

Bacterium tumefaciens, crown gall: New York, scattered distribution reported by R. F. Suit; Oklahoma, in Craig and Oklahoma Counties; Wisconsin, less prevalent than for several previous years; Texas, in Brazos and Smith Counties. Botrytis sp., blight: New York; Nebraska; and Washington, in Kittitas and Yakima Counties. B. cinerea: New Jersey, in Middlesex and Monmouth Counties.

Coniothyrium fuckelii, canker, in Oklahoma, was frequently intercepted by State Nursery Inspectors; New Jersey; Texas, in Hamilton, Smith, and Brazoria Counties. C. wernsdorffiae, canker, was also frequently intercepted in Oklahoma by State Nursery Inspectors.

Diplocarpon rosae, black spot, was again severe in Massachusetts this year. Most seen in 10 years in several commercial greenhouses, according to W. H. Davis (PDR 22: 297); in New York, according to R. F. Suit, specimens were sent in from Long Island; Louisiana, in East Baton Rouge, West Baton Rouge, Saint Martin, and Lafayette Parishes; Texas, general in western part of the State; Oklahoma; Michigan, "No longer important in greenhouses. The most common disease on roses in gardens. Difficult to control"; more prevalent in Wisconsin owing to the cool and wet weather; Minnesota, in Brown, Hennepin, Ramsey, and Washington Counties; Nebraska; Kansas, more prevalent than in 1937; Washington, in King County. Diplodia sp., die-back: Texas, in Smith County. Leptosphaeria coniothyrium, canker: New Jersey, in Bergen County; Washington, in Spokane County.

Phragmidium sp., rust: R. E. Vaughan reported, "Only seen a few times" in Wisconsin; Minnesota, much more prevalent than for several previous years, reported from 9 counties. P. americanum, rust: Texas, in Smith County. First report from the State to the Survey; Nebraska. P. disciflorum, rust: Washington, in Whitman County. Phymatotrichum omnivorum, root rot: Texas, in Navarro, Bell, and Bexar Counties. Sphaceloma rosarum, anthracnose: Palo Alto, California, first specimen from this locality. Sphaerotheca sp., powdery mildew: Oklahoma and Minnesota. S. humuli, powdery mildew: New York and Nebraska.

Sphaerotheca pannosa, powdery mildew, was reported by O. C. Boyd as notably conspicuous and damaging this year in Massachusetts; New York; New Jersey, in Bergen, Monmouth, Passaic, and Union Counties; Pennsylvania; Texas; Michigan, "Common out-of-doors on hybrid teas and climbers. In greenhouses controlled by heavy syringing"; Wisconsin, more prevalent than in 1937 owing to the wet weather; Kansas, "Very little noted"; Washington, in Spokane, Whitman, Benton, and Cowlitz Counties. Heterodera marioni, root knot: Texas, in Smith County.

Mosaic (virus): Morris County, New Jersey; Minnesota, Anoka County, 1 report; Texas, in Smith and Van Zandt Counties. Streak (virus): Texas, in Smith and Van Zandt Counties. Chlorosis (non-parasitic): Texas in Bell and Hidalgo Counties; Washington, in Whatcom County.

SEMPERVIVUM sp. HOUSELEEK:

Endophyllum sempervivi, rust: Specimen collected at Worcester, Massachusetts. This short cycled rust has been known heretofore only from a limited area in New Jersey and New York in the vicinity of New York (PDR 22: 357).

SENECIO CINERARIA. SILVER CINERARIA:

Streak (virus): Washington, in Spokane County.

SHEPHERDIA CANADENSIS. RUSSET BUFFALOBERRY:

Puccinia caricis-shepherdiae, rust, was reported from Crede, which is near the Rio Grande Dam and Reservoir in Colorado.

SINNINGIA SPECIOSA. GLOXINIA:

Sclerotinia sclerotiorum, stem, leaf, and petiole rot: California (PDR 22: 356).

SPIRAEA spp. SPIREA and BRIDALWREATH:

Cylindrosporium filipendulae, leaf spot, was reported by I. E. Melhus from Iowa, causing a trace loss. Phymatotrichum omnivorum, root rot: Texas, in Bell County on S. prunifolia, bridalwreath. Sphaerotheca humuli, powdery mildew: Cohocton, New York. Chlorosis (non-parasitic): Texas, in Bell County on S. prunifolia, bridalwreath.

SYMPHORICARPOS sp. SNOWBERRY:

Glomerella cingulata, anthracnose of fruit and stem blight, was reported from Massachusetts by Davis as being more prevalent in 1938 than for several previous years. Estimated reduction in yield of fruit was 90 percent. Most of the shrubs in the Connecticut Valley were killed; Wisconsin reported anthracnose as being more prevalent than in 1937.

SYMPHORICARPOS VULGARIS. CORALBERRY:

Microsphaera diffusa, powdery mildew: Texas and Oklahoma. Phomopsis sp., stem galls: Specimens were collected at Takoma Park, Md., in the early summer of 1938 (PDR 22: 349-350).

SYRINGA VULGARIS. LILAC:

Cladosporium sp., leaf blight, was reported from Pennsylvania by R. S. Kirby, causing a trace loss. Gloeosporium sp., leaf blight: Massachusetts. Microsphaera alni, powdery mildew: Massachusetts, New York, Texas, Oklahoma, Wisconsin, and Minnesota reported the disease more prevalent than in 1937; other States reporting the disease were Iowa, Nebraska, and Kansas.

Phymatotrichum omnivorum, root rot: Texas, in Bell County. Phytophthora cactorum, blight: Minnesota, in Ramsey County. Bacterium syringae, leaf blight: Massachusetts and New York reported its occurrence; in Michigan, according to Ray Nelson, the disease was important in two large commercial plantings at Lansing and Flint; Washington, in Whatcom and Lewis Counties.

TAGETES spp. MARIGOLD:

Phytophthora cryptogea, wilt, was reported on T. erecta at Ithaca, Tompkins County, New York. Pythium ultimum caused root and stem rot of French marigold (T. patula) in the San Francisco Bay region of California. Leaf spotting: A serious leaf spotting disease caused heavy damage to a bed of marigolds in Amherst, Massachusetts (PDR 22: 338).

TROPAEOLUM MAJUS. NASTURTIUM:

Bacterium aptatum, leaf spot, was reported from Faribault County, Minnesota, by L. Dosdall, with the comment, "First observation." First report to the Survey on the host from this State.

TULIPA sp. TULIP:

Botrytis sp., blight, was reported more prevalent in Wisconsin owing to the wet weather. B. tulipae, blight, was conspicuous and damaging in Massachusetts, according to O. C. Boyd; New Jersey, in Essex County; in Michigan Ray Nelson reported, "In old plantings a destructive disease. Annual lifting and replanting controls it"; Minnesota reported the disease much more prevalent than for several previous years. It occurred in 11 southeastern counties; Washington, in Stevens and Lewis Counties.

VACCINIUM ARBOREUM. TREE HUCKLEBERRY:

Ophiodothella vaccinii, leaf blight: Mississippi, in Hinds County; Texas, in Cherokee County.

VIBURNUM spp. VIBURNUM:

Bacterium sp., bacterial leaf spot: Monmouth County, New Jersey. Phytomonas viburni, viburnum leaf spot, was found this year near Des Plaines, Illinois, on V. opulus. According to H. W. Anderson and H. H. Thornberry, this leaf spot appears each year on one clump of shrubs in its original location at Urbana and has never been observed elsewhere until this season (PDR 22: 367).

VIOLA spp. VIOLET:

Cercospora violae, leaf spot, was found in widely scattered areas (Washington and Caddo Parishes) in Louisiana, according to A. G. Plakidas. Puccinia violae, rust: Washington, in King County. Sphaceloma violae, scab, was reported from Pennsylvania with the usual prevalence. Curly top (virus): Oregon (PDR 23: 108).

ZANTEDESCHIA sp. CALLA LILY:

Erwinia aroideae, soft rot, was reported more severe than usual in New Jersey by the Plant Pathology Department. Phytophthora cryptogea richardiae, root rot, in New Jersey was reported the most serious fungus disease affecting calla lily. Spotted wilt (virus): Washington, in Spokane County.

ZINNIA ELEGANS. ZINNIA:

Alternaria sp., leaf spot: In New York, A. W. Dimock reported the disease "Apparently increasing in severity." Erysiphe cichoracearum, powdery mildew: Kansas; Texas, in Tarrant, Bell, and Lamb Counties; Oklahoma, "Garden zinnias very heavily affected at Stillwater and Idabel." Sclerotinia sclerotiorum, stem rot: California (PDR 22: 356). Heterodera marioni, root knot: Texas, in Howard County.

Mosaic (virus): Chester reported, "Plentiful in gardens around Stillwater, Oklahoma. Severe and mild strains both present, mechanically transmissible"; Kansas.

INDEX OF ORGANISMS AND NON-PARASITIC DISEASES

in

THE PLANT DISEASE REPORTER

SUPPLEMENTS 112 - 119, 1939.

Prepared by Nellie W. Nance

Plant Disease Reporter
Supplement 120 December 31, 1939

Supplement 113, "1937 and 1938 additions and corrections to the list of causes of fungous and bacterial plant diseases in Maine," is indexed on pages 22-26.

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On page 160 under BUCHLOE DACTYLOIDES, read Anguillulina agrostidis instead of Anguillulina agrostis.

On page 161 read Puccinia graminis, stem rust, on E. canadensis instead of Puccinia condensatus, stem rust, on E. canadensis.

14